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1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

August 1988

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1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

(CRC PROJECT No. CM-123-87)

Prepared by the

1987 Analysis Panel

of the

CRC Octane Number Requirement Survey Group

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

August 1988

Automotive Vehicle Fuel, Lubricant, and Equipment Research Committee

of the

Coordinating Research Council, Inc.

ABSTRACT

In the forty-first annual statistical survey of current model vehicles conducted by the Coordinating Research Council, Inc., test data were obtained on 389 1987 model vehicles, including 300 passenger cars and 89 light-duty trucks and vans. Eighteen laboratories participated in this Survey. Maximum octane number requirements were determined by testing at maximum-throttle conditions, as well as at part-throttle. Requirements are expressed as the (R+M)/2 octane number, Research octane number, and Motor octane number of the reference fuel producing knock which was recurrent and repeatable at the lowest audible level. The primary analyses used in this report are based upon (R+M)/2 octane number requirements, rather than upon Research octane number requirements as in Survey reports prior to 1985. Estimated octane number requirements for the total vehicles are weighted in proportion to the 1987 vehicle model production and/or sales figures. The maximum octane number requirements of 1987 models with FBRU fuels were 85.7 (R+M)/2 octane numbers at the 50 percent satisfaction level, and 90.5 (R+M)/2 octane numbers at the 90 percent satisfaction level. These requirements reflect an increase from 1986 of 0.4 and 0.7 (R+M)/2 octane numbers.

fuels.

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I. INTRODUCTION

In the forty-first annual statistical survey of current model vehicles conducted by the Coordinating Research Council, Inc., test data were obtained on 389 1987 model-year vehicles, including 136 knock sensor-equipped vehicles and 8 select models of special interest. Three of the select models were equipped with knock sensors.

Passenger cars and light-duty trucks including vans were tested to represent the 1987 vehicle population in the United States. This year's Survey includes analyses for the following vehicle categories:

(1)	Total Vehicles	-- 389 vehicles
(2)	Total Cars	-- 300 cars
(3)	Total Trucks and Vans	-- 89 vehicles
(4)	Total Knock-Sensor Vehicles	-- 136 vehicles

It should be noted that the term "cars" designates passenger cars only, while the term "vehicles" includes passenger cars plus vans and light-duty trucks. The term "total" includes both US and imported models.

Eighteen laboratories participated in this Survey; they are listed in Appendix A. Members of the CRC Octane Number Requirement Survey Analysis Panel are identified in Appendix B.

II. SUMMARY

Data were collected on 389 1987 model-year vehicles. These vehicles consisted of 300 passenger cars and 89 light-duty trucks and vans. The average deposit mileage in this Survey was 13,720. The weighted average engine displacement and compression ratio were 2.91 liters and 8.98, respectively. One hundred thirty-six vehicles were equipped with knock sensors. The 1987 Survey included sufficient data for eight specific models which were analyzed separately as select models. All select models had automatic transmissions.

Requirements are expressed as the (R+M)/2 octane number, Research octane number (RON), and Motor octane number (MON) of the reference fuel which produced knock that was recurrent and repeatable at the lowest audible level. (This definition of borderline knock was used for the first time in the 1984 Survey.) Estimated octane number requirements for the vehicles are weighted in proportion to the 1987 vehicle model production and/or sales figures.

It should be noted that the primary analyses used in this report are based upon (R+M)/2 octane number requirements, rather than upon RON requirements as in Survey reports prior to 1985.

Part-throttle requirements were defined when their requirements were higher than the maximum-throttle requirements or, with FBRU fuels only, when they were within four octane numbers of maximum-throttle requirements. The maximum requirements listed for the 1987 Survey were reported by the same method used in prior Surveys. The greater of the maximum-throttle or part-throttle requirement is used, except when both the maximum-throttle and part-throttle requirements are the same. In that case, the computer selects the part-throttle requirement as the maximum octane number requirement. Maximum (high-borderline) and minimum (low-borderline) octane number requirements were reported for the knock sensor-equipped vehicles when determined.

This is the fifth Survey in which requirements for knock sensor-equipped vehicles were included in the distribution. The base analysis case for this report uses the maximum (high-borderline) octane number requirements of these vehicles. The following table for FBRU fuels presents maximum 1987 octane number requirements and changes from 1986 for the four weighted populations, at the 50 percent and 90 percent satisfaction levels, as well as illustrating the effect of using maximum (high-borderline) or minimum (low-borderline) for knock sensor-equipped vehicles on these four populations. At the current market penetration levels, inclusion of the knock sensor-equipped vehicles at their minimum (low-borderline) requirement reduces the total vehicle population requirements relative to those calculated at their maximum (high-borderline) requirements by 0.3 (R+M)/2 at the 50 percent satisfaction level, and 0.7 (R+M)/2 at the 90 percent satisfaction level.

FBRU (R+M)/2 OCTANE NUMBER REQUIREMENTS

1987 AND CHANGES FROM 1986

Weighted Population	KS-H**	Δ from 1986	KS-L***	Δ from 1986
50% Satisfaction				
Total Vehicles (35.0%)*	85.7	+0.4	85.4	+0.6
Total Cars (31.3%)	85.4	+0.4	85.1	+0.3
Total Trucks (47.2%)	86.3	-0.3	85.8	+0.1
Total Knock-Sensor Vehicles	86.6	+1.2	85.5	+2.1
90% Satisfaction				
Total Vehicles (35.0%)*	90.5	+0.7	89.8	+0.8
Total Cars (31.3%)	90.4	+0.9	89.9	+1.0
Total Trucks (47.2%)	91.6	+1.3	90.0	+0.1
Total Knock-Sensor Vehicles	91.9	+1.7	89.9	+1.3

* Knock sensor-equipped vehicles as percent of the associated population.

** KS-H = Population with knock sensor-equipped vehicles at maximum (high-borderline) requirement.

*** KS-L = Population with Knock Sensor-Equipped Vehicles at minimum (low-borderline) requirement.

Maximum octane requirements for the select models at the 50 percent and 90 percent satisfaction levels for FBRU fuels are summarized in the following table:

SELECT MODELS

MAXIMUM FBRU OCTANE NUMBER REQUIREMENTS

Select Model	No. Tested	(R+M)/2 50% Sat.	(R+M)/2 90% Sat.
NAR T25A3/MAR T25A3/IAR T25A3/ LAR T25A3	17	88.9	92.3
NJ1 T20A3/LJ1 T20A3	13	85.1	87.6
NAW P28A3/HAW P28A3/IAW P28A3/ LAW P28A3/NJW P28A3/GJW P28A3 (High Borderline)	10	88.0	93.6
NAW P28A3/MAW P28A3/IAW P28A3/ LAW P28A3/NJW P28A3/GJW P28A3 (Low Borderline)	10	87.5	93.3
IH3 P38A4/IC3 P38A4/MH3 P38A4/ LH3 P38A4/LC3 P38A4 (High Borderline)	15	85.5	89.3
IH3 P38A4/IC3 P38A4/MH3 P38A4/ LH3 P38A4/LC3 P38A4 (Low Borderline)	15	84.1	88.2
PED T22A3/PKD T22A3/PPD T22A3/ KKA T22A3 KPD T22A3/DMD T22A3	10	84.6	88.2
OE9 T19A3/ME9 T19A3	12	86.7	90.6
OPF P50A4/OSF P50A4/MPF P50A4/ MSF P50A4/SPF P50A4	12	83.5	87.6
ORU P30A4/MRU P30A4 (High Borderline)	17	87.9	91.2
ORU P30A4/MRU P30A4 (Low Borderline)	17	86.8	90.0

Part-throttle octane requirements were equal to or higher than the maximum-throttle octane requirements on 29 percent of all 1987 vehicles with FBRU fuels. Using the analytical technique of 1986 and earlier Surveys, which reports only the instances in which part-throttle octane requirements exceed the maximum-throttle octane requirements, the instance of part-throttle knock would be 14 percent. This compares with 8 percent in 1986, 10 percent in 1985, and 9 percent in 1984.

In the 1987 Survey, 33 percent of the weighted vehicle population knocked on tank fuel, which compares with 31 percent in the 1986 Survey and 37 percent in the 1985 Survey.

III. TEST VEHICLES

This year's Survey tested a total of 389 1987 model vehicles, compared with 377 vehicles in the 1986 Survey. The analysis of the data included 300 passenger cars and 89 vans and light-duty trucks. Also included are 136 knock sensor-equipped vehicles (94 cars and 42 trucks).

Beginning with the 1987 Survey, test vehicles are divided into four main categories:

(1) Total Vehicles, which includes all US and imported passenger cars, vans, and light-duty trucks

(2) Total Cars, which includes all US and imported passenger cars

(3) Total Trucks, which includes all US and imported vans and light-duty trucks

(4) Total Knock-Sensor Vehicles, which includes all knock sensor equipped US and imported passenger cars, vans, and light-duty trucks.

In the 1987 Survey, 81 percent of the transmissions were automatic. Fifty-four percent of the automatics were three-speeds, and the rest four-speeds. The manual transmissions were divided into twelve four-speeds and sixty five-speeds. Eighty-nine percent of the surveyed vehicles were air-conditioned. A sufficient amount of data (ten or more vehicles) was obtained for eight specific select models. These select models are described in Table I.

Table II shows the distribution of odometer mileage for both the 1987 and 1986 Surveys. The 1987 distribution is shown as a bar chart in Figure 1. The average odometer mileage was 13,720. Three vehicles with odometer mileages less than 6,000 miles were included in the analysis. The weighted average displacement in 1987 was 2.91 liters, compared with 3.00 in 1986. The weighted average compression ratio in 1987 was 8.98 compared with 8.87 in 1986.

The basic timing was adjusted to the manufacturer's recommended setting (within $\pm 1°$) prior to testing. A total of thirty-two vehicles were adjusted; twenty-four were two or more degrees off from the manufacturer's setting. The number of vehicles and their deviation in spark setting are shown in Table III.

Participants were requested to rate specific vehicle models in a pattern which would minimize data bias due to differences among testing laboratories and vehicles. To accomplish this, the United States was divided into four geographical areas, and laboratories within each geographical area were requested to test specific vehicles.

IV. REFERENCE FUELS

Three series of reference fuels were used in the 1987 Survey:

- Primary Reference (PR) Fuels;
- Average Sensitivity Full-Boiling Range Unleaded (FBRU) Reference Fuels with sensitivities similar to those of normal commercial gasoline; and
- High-Sensitivity Full-Boiling Range Unleaded (FBRSU) Reference Fuels with sensitivities about two octane numbers higher than the FBRU fuels.

A. PR Fuels

Isooctane and normal heptane, meeting ASTM specifications, were blended in two octane number increments from 76 to 82 octane number, and in one octane number increments from 82 to 100 octane number.

B. FBRU Reference Fuels

FBRU fuels were prepared from three base blends (RMFD-362-87/88, RMFD-363-87/88, and RMFD-364-87/88) in two octane number increments from 80 to 84 RON, and in one octane number increments from 84 to 103 RON. The base blends were prepared from normal refinery components. Inspection data furnished by the supplier are shown in Appendix C, Table C-I. The composition and average laboratory octane data for the 1987/1988 FBRU reference fuel series are presented in Appendix C, Table C-II.

C. FBRSU Reference Fuels

FBRSU fuels were prepared from three base blends (RMFD-365-87/88 RMFD-366-87/88, and RMFD-367-87/88) in two octane number increments from 80 to 84 RON, and in one octane number increments from 84 to 102.8 RON. The base blends were prepared from normal refinery components. Inspection data furnished by the supplier are shown in Appendix C, Table C-III. The laboratory blending octane data for the 1987/1988 FBRSU reference fuels are presented in Table C-IV.

V. TEST TECHNIQUE

The test technique (CRC Designation E-15-87, Attachment 2 of Appendix D) specified that octane number requirements be determined at level road acceleration conditions. The order of fuel testing was tank fuel, FBRSU fuels, FBRU fuels, and PR fuels. Knocking tendencies were investigated using both maximum-throttle and part-throttle acceleration techniques.* Part-throttle was investigated in each vehicle to determine if the part-throttle requirement was higher or equal to the maximum-throttle requirement. In these cases, the part-throttle requirement search was conducted with all three fuels. Part-throttle requirements were also determined with FBRU fuels down to four Research octane numbers below the maximum requirement at maximum-throttle.

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* Maximum-throttle is either full-throttle for manual transmissions or widest throttle position (detent) that does not cause the transmission to downshift for automatic transmissions.

The maximum octane number requirement of a vehicle is defined as the (R+M)/2, Research, or Motor octane number of the highest octane test fuel producing borderline knock. This requirement is defined at either maximum- or part-throttle acceleration conditions. For vehicles equipped with knock sensors, the technique identifies the highest octane fuel that gives borderline knock (maximum or high-borderline requirement) and the lowest octane fuel that gives borderline knock (minimum or low-borderline requirement). Requirements are expressed as the (R+M)/2 octane number, Research octane number (RON), and Motor octane number (MON) of the reference fuel which produces knock that is recurrent and repeatable at the lowest audible level.

Of the eighteen laboratories participating in the 1987 Survey, four used level roads and fourteen used chassis dynamometers. Seventy-nine percent of the cars were tested on chassis dynamometers.

Average test temperature was 67°F, with a barometric pressure average of 29.85 inches Hg and average humidity of 48.8 grains per pound. Test conditions for individual observations are reported in Appendix E.

The table below shows the average ambient conditions and the average odometer readings for the last four surveys.

Average Ambient Test Conditions

Year	Temperature, F°	Barometric Pressure, inches Hg	Humidity, grains per pound	Mileage
1984	70	29.86	61.0	11374
1985	69	29.91	56.6	12343
1986	70	29.83	58.2	11849
1987	67	29.85	48.8	13720

There is general agreement that ambient temperature, pressure, and humidity can influence the octane number requirement of a vehicle at any time. [1,2] Octane requirement increases as temperature and pressure increase, and as humidity decreases. The coefficients of these effects are difficult to determine and may be dependent upon the vehicle. In the 1987 Survey, the average humidity was significantly lower than in previous years. Directionally, this would cause the results of this Octane Number Requirement Survey to be slightly higher than would be the case if the humidity had been in the mid to high 50's. The average temperatures and pressures are similar enough so that differences in their effects on average octane number requirement are probably small.

CRC has gathered data on the effect of mileage on the octane requirement of cars from several model years. The most recent data [3] are for 1985 and 1986 model years, and show an average increase of 0.04 octane number per thousand miles for mileage accumulation between 10,000 and 15,000 miles. Based upon this information, the results of the 1987 Survey will tend to be higher than the results of the 1986 Survey, and the magnitude of the difference will be about 0.1 octane number.

VI. DISCUSSION OF RESULTS

A. Distribution of Maximum Octane Number Requirements

The octane number requirement data were used to prepare satisfaction curves and tables for the following samples of 1987 model vehicles:

(1) Total Vehicles,
(2) Total Cars,
(3) Total Trucks and Vans, and
(4) Total Knock-Sensor Vehicles.

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(1) B. D. Keller, J. H. Steury, T. O. Wagner, SAE Paper 780668 (1978)

(2) H. A, Bigley, Jr., B. D. Keller and M. G. Kloppe, SAE Paper 710675 (1971).

(3) CRC Project No. CM-124-85/86

Maximum (R+M)/2, RON, and MON requirements and 95 percent confidence limits for the four categories at 50 percent and 90 percent satisfaction are shown in Table IV. In preparing the curves and tables, the octane number requirement data were weighted in accordance with final 1987 model-year production and/or sales figures. Each curve and table, therefore, provides an estimate of the distribution of octane number requirements of the appropriate vehicle population on the road. The procedure for assigning weighting factors and for calculating the octane number requirement distributions is described in Appendix F.

Vehicles equipped with knock sensors were included in the 1987 models tested. All vehicles with knock sensors were tested for maximum (high-borderline) octane number requirements, and 123 of the 136 vehicles were tested for minimum (low-borderline) octane number requirements. Octane number requirement distributions were calculated for each group of vehicles using the requirements from those vehicles with knock sensors rated at maximum (high-borderline) requirement and with their ratings at minimum (low-borderline) requirement. Maximum octane number requirements for the 1987 model vehicles were considered to be the requirements which included the knock sensor-equipped vehicles at the maximum (high-borderline) requirement.

Requirements are expressed as the (R+M)/2, Research, and Motor octane numbers of the reference fuel which produced knock that was recurrent and repeatable at the lowest audible level. (This definition of borderline knock was used for the first time in the 1984 Survey.)

It should also be noted that the primary analyses used in this report are based upon (R+M)/2 octane number requirements, rather than upon Research octane number requirements as in reports prior to 1985.

1. Total Vehicles

In the 1987 Survey, maximum octane number requirements were determined on 389 vehicles with PR, FBRU, and FBRSU fuels. One hundred thirty-six of the vehicles were equipped with knock sensors.

Maximum (R+M)/2 octane number requirements for all three reference fuels are shown in Figures 2, 3, and 4. Each plot compares the requirements with total vehicles, including knock-sensor vehicles, with ratings at the maximum (high-borderline) level and the minimum (low-borderline) level. The maximum (R+M)/2 octane number requirements for all three reference fuels are plotted in Figure 5. The octane number requirement distributions for FBRU and FBRSU fuels are similar. Maximum (R+M)/2, Research, and Motor octane number requirements are listed in Table V. Octane number requirements with knock sensor-equipped vehicles tested at minimum (low-borderline) levels are given in Table VI. The 50 percent and 90 percent satisfaction level requirements are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Vehicles)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	87.9	87.9	87.9	93.5	93.5	93.5
FBRU	85.7	89.8	81.6	90.5	95.6	85.4
FBRSU	85.5	90.9	80.1	91.1	97.4	84.8

Differences between 1987 and 1986 Survey maximum (R+M)/2, Research, and Motor octane number requirements are also shown in Tables V and VI for all three fuel series. Distributions of the 1987 and 1986 maximum (R+M)/2 requirements are shown in Figure 6 for FBRU fuels. The differences at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1987 AND 1986 MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Vehicles)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	+0.3	+0.3	+0.3	+0.6	+0.6	+0.6
FBRU	+0.4	+0.6	+0.2	+0.7	+0.8	+0.5
FBRSU	+0.3	+0.5	+0.1	+1.3	+1.5	+1.1

Confidence limits for maximum octane number requirement distributions are given in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 octane number requirements were $\pm$0.4 at the 50 percent satisfaction level, and varied $\pm$0.5 to $\pm$0.6 at the 90 percent satisfaction level.

2. Total Cars

Maximum octane number requirements were determined on 300 cars with PR, FBRU, and FBRSU fuels.

Maximum (R+M)/2, RON, and MON requirements on all three fuel series are given in Table VII. Octane number requirements with knock sensor-equipped vehicles tested at minimum (low-borderline) levels are given in Table VIII. The maximum (R+M)/2 octane number requirement distributions for all three reference fuels are plotted in Figure 7. Maximum octane number requirements at the 50 percent and 90 percent satisfaction levels are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Cars)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	87.4	87.4	87.4	93.1	93.1	93.1
FBRU	85.4	89.4	81.3	90.4	95.5	85.2
FBRSU	85.2	90.5	79.9	90.7	97.0	84.5

Differences between the 1987 and 1986 Survey maximum (R+M)/2, RON, and MON requirements are also shown in Tables VII and VIII for PR, FBRU, and FBRSU fuels. Differences between 1987 and 1986 data at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1987 AND 1986 MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Cars)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	+0.1	+0.1	+0.1	+0.5	+0.5	+0.5
FBRU	+0.4	+0.6	+0.1	+0.9	+1.1	+0.6
FBRSU	+0.4	+0.6	+0.2	+1.1	+1.4	+1.0

Confidence limits for maximum octane number requirement distributions of 1987 Total cars are given in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 requirements varied from $\pm$0.4 to $\pm$0.5 at the 50 percent satisfaction level, and from $\pm$0.6 to $\pm$0.7 at the 90 percent satisfaction level.

3. Total Trucks and Vans

Maximum octane number requirements were determined on eighty-nine trucks and vans with PR, FBRU, and FBRSU fuels. Maximum (R+M)/2 octane number requirements for all three reference fuel series are plotted in Figure 8. Maximum octane number requirements in terms of (R+M)/2, RON, and MON are given in Table IX. Octane number requirements with knock sensor-equipped trucks and vans tested at minimum (low-borderline) levels are given in Table X. The 50 percent and 90 percent satisfaction level maximum octane number requirements are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(Total Trucks and Vans)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	89.2	89.2	89.2	94.0	94.0	94.0
FBRU	86.3	90.5	82.0	91.6	97.0	86.3
FBRSU	86.0	91.5	80.6	92.2	98.5	85.8

Differences between the maximum (R+M)/2, RON, and MON requirements of trucks and vans in the 1987 and 1986 Surveys are also given in Tables IX and X for all three fuel series. The differences at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1987 AND 1986 MAXIMUM* OCTANE NUMBER REQUIREMENTS

(Total Trucks and Vans)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	-0.1	-0.1	-0.1	+0.1	+0.1	+0.1
FBRU	-0.3	-0.5	-0.2	+1.3	+1.7	+1.0
FBRSU	-0.2	-0.5	+0.3	+1.7	+1.8	+1.4

*1986 maximum octane number requirements estimated from CRC Report No. 553, "1986 CRC Octane Number Requirement Survey."

Confidence limits for maximum octane number requirement distributions of 1987 trucks and vans are tabulated in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 octane number requirements varied from +0.6 to +0.8 at the 50 percent satisfaction level, and from $\pm$0.9 to $\pm$1.1 at the 90 percent satisfaction level.

4. Total Knock-Sensor Vehicles

Maximum octane number requirements (high-borderline) were determined on 136 total vehicles containing knock sensors on PR, FBRU, and FBRSU fuels. Minimum (low-borderline) octane number requirements were determined on 123 vehicles.

The distributions of maximum (R+M)/2 octane number requirements at the maximum (high-borderline) and the minimum (low-borderline) levels are shown in Figures 9 and 10, respectively, for the three fuel series. Maximum (R+M)/2, RON, and MON requirements for all three fuel series are given in Table XI. Octane number requirements with knock sensor-equipped vehicles tested at minimum (low-borderline) levels are given in Table XII. Maximum octane number requirements for the 50 percent and 90 percent satisfaction levels are:

MAXIMUM OCTANE NUMBER REQUIREMENTS

(1987 Total Knock-Sensor Vehicles)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	89.0	89.0	89.0	94.6	94.6	94.6
FBRU	86.6	90.9	82.2	91.9	97.3	86.5
FBRSU	86.1	91.6	80.6	92.6	99.0	86.2

Differences between 1987 and 1986 Survey maximum (R+M)/2, RON, and MON requirements are also shown in Tables XI and XII. Distributions of maximum (R+M)/2 octane number requirements are shown in Figure 11 for FBRU fuels. The differences at the 50 percent and 90 percent satisfaction levels are:

DIFFERENCES BETWEEN 1987 AND 1986 MAXIMUM OCTANE NUMBER REQUIREMENTS

(1987 Total Knock-Sensor Vehicles)

	50% Satisfied			90% Satisfied		
Fuel	(R+M)/2	RON	MON	(R+M)/2	RON	MON
PR	+0.8	+0.8	+0.8	+1.2	+1.2	+1.2
FBRU	+1.2	+1.6	+0.7	+1.7	+2.1	+1.3
FBRSU	+0.7	+1.0	+0.5	+2.5	+2.8	+2.2

The differences between the maximum octane number requirements of 136 vehicles tested, and the octane number requirements at minimum (low-borderline) levels of 123 vehicles are:

DIFFERENCES BETWEEN MAXIMUM AND MINIMUM OCTANE NUMBER REQUIREMENTS

(1987 Total Knock-Sensor Vehicles)

Fuel	50% Satisfied (R+M)/2	50% Satisfied RON	50% Satisfied MON	90% Satisfied (R+M)/2	90% Satisfied RON	90% Satisfied MON
PR	+0.2	+0.2	+0.2	+1.4	+1.4	+1.4
FBRU	+1.1	+1.3	+0.8	+2.0	+2.4	+1.6
FBRSU	+1.1	+1.3	+0.9	+1.6	+1.7	+1.4

Confidence limits for maximum octane number requirement distributions of 1987 knock-sensor vehicles are given in Appendix G, Table G-1. The 95 percent confidence limits for (R+M)/2 octane number requirements (high-borderline) varied between ±0.7 and ±0.8 at the 50 percent satisfaction level, and between ±0.9 and ±1.1 at the 90 percent satisfaction level.

The 95 percent confidence limits for (R+M)/2 octane number requirements (low-borderline) varied between ±0.6 and ±0.7 at the 50 percent satisfaction level, and between ±0.8 and ±1.0 at the 90 percent satisfaction level.

B. Part-Throttle Requirements

Part-throttle octane requirements were equal to or higher than the maximum-throttle octane requirements on 29 percent of all 1987 vehicles with FBRU fuels. Using the analytical technique of 1986 and earlier Surveys, which reports only the instances in which part-throttle octane requirements exceed the maximum-throttle octane requirements, the instance of part-throttle knock would be 14 percent. This compares with 8 percent in 1986, 10 percent in 1985, and 9 percent in 1984.

C. Select Models

Eight select models with unique engine-chassis combinations were tested. The select models tested in this year's Survey included three knock sensor-equipped models. The identification and specifications of the engine-chassis combinations of the select models are in Table I.

Maximum octane number requirements for each select model at various satisfaction levels are listed in Tables XIII through XX. The maximum (high-borderline) and minimum (low-borderline) octane number requirements for the three knock sensor-equipped models are given in Tables XV, XVI, and XX.

D. Tank Fuel

Tank fuel was tested for incidence of knock on all vehicles. Owners' questionnaires, however, were obtained only when the vehicle tested had a regular driver and the ignition timing did not have to be reset.

1. Owner/Rater Comparisons of Tank Fuel Knock

For 179 vehicles, both owner and rater data were reported, and no adjustments of spark timing were made. The trained raters reported that 40 percent of the vehicles knocked, while the owners reported that 24 percent knocked, an owner/rater knock ratio of 0.60. The 40 percent of vehicles found to be knocking by trained raters is higher than in the 1986 Survey. These owner/rater comparisons of tank fuel knock for 1987, along with previous Survey data back to 1980, are presented in Table XXI.

Tank fuel RON and MON data were reported for a total of 137 vehicles with both owner/rater data and no adjustments of spark timing. One-hundred-four vehicles were reported to have tank fuel octane numbers less than 90.0 (R+M)/2. Trained observers reported knock on 44 percent of these, compared with 26 percent for owners. Of the other thirty-three vehicles having tank fuels greater than or equal to 90.0 (R+M)/2, 21 percent knocked according to trained raters, and 12 percent according to owners.

2. Objectionable Versus Non-Objectionable Knock

Of the owners reporting tank-fuel knock with vehicles which had no change in spark timing, 12 percent found the knock to be objectionable, in comparison with 15 percent in the 1986 Survey. Comparisons of objectionable knock for 1980 through 1987 Surveys are also given in Table XXI.

3. Tank Fuel Knock Reported by Trained Raters

Tank fuel knock observations were reported for 322 of the 389 vehicles tested. The percentages of all 1987 vehicles knocking on tank fuel are shown in Table XXII. On both a weighted and unweighted basis, 35 percent of the 1987 vehicles tested knocked on tank fuel, compared with 31 percent (weighted) and 32 percent (unweighted) in the 1986 Survey.

The percentages of selected models knocking on tank fuel, also shown in Table XXII varied from a low of 10 percent to a high of 73 percent.

E. Engine Speed for Maximum Octane Number Requirements

Engine speeds at which maximum octane number requirements occurred for each select model are shown in Table XXIII for PR, FBRU, and FBRSU fuels. Weighted data for all 1987 vehicles are shown in Table XXIV.

F. Gear Position for Maximum Octane Number Requirements

The throttle/gear position for maximum octane number requirements on FBRU fuels is shown in Table XXV. Of the 389 vehicles tested, 317 (81 percent) were equipped with automatic transmissions and 72 (19 percent) were equipped with manual transmissions.

Maximum requirements at maximum-throttle occurred in 73 percent of the automatic transmission vehicles (17 percent in fourth gear, 37 percent in third gear, and 19 percent in second gear). Maximum requirements at part-throttle occurred in 27 percent of the automatic transmission vehicles (7 percent in fourth gear, 18 percent in third gear, and 2 percent in second gear).

For manual transmission vehicles, 62 percent had maximum requirements at maximum-throttle (56 percent in fourth gear and 6 percent in third gear). Maximum requirements at part-throttle occurred in 38 percent of manual transmission vehicles (35 percent in fourth gear, and 3 percent in third gear). Fifth gear for five-speed manual transmissions was not examined per program instructions.

TABLES

AND

FIGURES

TABLE I

1987 SELECT MODEL SPECIFICATIONS

Model	Knock Sensor	Disp. (L)	Engine Type	Fuel System Type*	Comp. Ratio	Brake HP	Trans-mission
Chrysler Corporation:							
Carravelle/Reliant/Sundance/ Aries/Shadow/Lebaron GTS		2.2	L4	TBI	9.5	97	A3
Ford Motor Company:							
Escort/Lynx		1.9	L4	TBI	9.0	90	A3
Taurus/Sable	KS	3.0	V6	MFI	9.3	140	A4
LTD Crown Victoria/ Thunderbird/Grand Marquis/ Cougar/Town Car		5.0	V8	MFI	8.9	150	A4
General Motors Corporation:							
Cavalier/Skyhawk		2.0	L4	TBI	9.0	90	A3
Celebrity/6000/Ciera/Century		2.5	L4	TBI	8.3	98	A3
Celebrity/Cavalier/6000/Ciera/ Century/Cimarron	KS	2.8	V6	MFI	8.9	125	A3
Bonneville/Delta 88/Regency/ LeSabre/Electra	KS	3.8	V6	MFI	8.5	150	A4

* TBI = Throttle Body Fuel Injection; MFI = Manifold Fuel Injection. Individual manufacturers may use different abbreviations.

TABLE II

DISTRIBUTION OF ODOMETER MILEAGE

FOR TESTED VEHICLES

Mileage	No. of Vehicles Within Mileage Increments	
	1986 Vehicles	1987 Vehicles
0 - 1,999	1	0
2,000 - 3,999	0	0
4,000 - 5,999	1	3
6,000 - 7,999	103	59
8,000 - 9,999	63	59
10,000 - 11,999	63	66
12,000 - 13,999	53	47
14,000 - 15,999	20	47
16,000 - 17,999	26	28
18,000 - 19,999	16	25
20,000 - 24,999	14	32
25,000 - 29,999	13	12
30,000 +	4	11
No. of Vehicles	377	389
Average Mileage	11,849	13,720

TABLE III

1987 BASIC TIMING ADJUSTMENTS

Degrees From Manufacturer's Setting	No. of Vehicles	
	+	-
1	5	3
2	6	8
3	2	2
4	1	0
5	1	2
6	0	1
7	1	0
8	0	0
9	0	0
10	0	0
11+	0	0
	16	16
TOTAL	32	

TABLE IV

MAXIMUM OCTANE NUMBER REQUIREMENTS WITH 95% CONFIDENCE LIMITS

	Fuel	No. Vehicles	(R+M)/2		Research Octane No.		Motor Octane No.	
			50% Sat.	90% Sat.	50% Sat.	90% Sat.	50% Sat.	90% Sat.
Total Vehicles	PR	389	87.9±0.4	93.5±0.6	87.9±0.4	93.5±0.6	87.9±0.4	93.5±0.6
	FBRU	389	85.7±0.4	90.5±0.5	89.8±0.4	95.6±0.6	81.6±0.3	85.4±0.4
	FBRSU	389	85.5±0.4	91.1±0.6	90.9±0.5	97.4±0.7	80.1±0.4	84.8±0.5
Total Cars	PR	300	87.4±0.5	93.1±0.7	87.4±0.5	93.1±0.7	87.4±0.5	93.1±0.7
	FBRU	300	85.4±0.4	90.4±0.6	89.4±0.6	95.5±0.8	81.3±0.4	85.2±0.5
	FBRSU	300	85.2±0.5	90.7±0.7	90.5±0.6	97.0±0.8	79.9±0.4	84.5±0.6
Total Trucks and Vans	PR	89	89.2±0.8	94.0±1.1	89.2±0.8	94.0±1.1	89.2±0.8	94.0±1.1
	FBRU	89	86.3±0.6	91.6±0.9	90.5±0.8	97.0±1.1	82.0±0.5	86.3±0.7
	FBRSU	89	86.0±0.8	92.2±1.0	91.5±0.9	98.5±1.2	80.6±0.6	85.8±0.9
Total Knock-Sensor Vehicles	PR	136	89.0±0.7	94.6±1.0	89.0±0.7	94.6±1.0	89.0±0.7	94.6±1.0
	FBRU	136	86.6±0.7	91.9±0.9	90.9±0.8	97.3±1.1	82.2±0.5	86.5±0.7
	FBRSU	136	86.1±0.8	92.6±1.1	91.6±0.9	99.0±1.2	80.6±0.7	86.2±0.9

TABLE V

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL VEHICLES

(For Knock-Sensor Vehicles, Maximum Octane Number Requirements Are Used)

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986
10	82.9	+0.1	81.4	+0.1	84.7	+0.5	78.2	-0.3	80.8	-0.3	85.3	0.0	76.2	-0.8
20	84.7	+0.1	82.6	-0.1	86.1	+0.2	79.1	-0.5	82.0	-0.3	86.8	0.0	77.2	-0.7
30	85.9	+0.2	83.6	-0.2	87.2	0.0	79.9	-0.5	83.2	0.0	88.1	+0.3	78.2	-0.3
40	86.8	+0.1	84.6	+0.2	88.5	+0.4	80.7	-0.1	84.2	+0.1	89.4	+0.4	79.1	-0.1
50	87.9	+0.3	85.7	+0.4	89.8	+0.6	81.6	+0.2	85.5	+0.3	90.9	+0.5	80.1	+0.1
60	89.2	+0.5	86.7	+0.5	91.1	+0.8	82.4	+0.3	86.5	+0.3	92.1	+0.4	81.0	+0.3
70	90.4	+0.6	87.9	+0.9	92.5	+1.2	83.2	+0.5	87.7	+0.6	93.6	+0.8	81.9	+0.5
80	91.7	+0.6	88.8	+0.8	93.7	+1.1	84.0	+0.6	89.1	+1.0	95.1	+1.2	83.1	+0.8
90	93.5	+0.6	90.5	+0.7	95.6	+0.8	85.4	+0.5	91.1	+1.3	97.4	+1.5	84.8	+1.1
95	94.7	+0.6	92.6	+1.4	98.1	+1.7	87.0	+1.0	93.4	+2.2	99.9	+2.5	87.0	+2.0
98	96.9	+0.6	94.7	+1.5	100.5	+1.9	89.3	+1.5	-	-	-	-	-	-

TABLE VI

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL VEHICLES

(For Knock-Sensor Vehicles, Minimum Octane Number Requirements Are Used)

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986
10	82.6	+0.5	81.1	+0.7	84.3	+1.2	77.9	+0.2	80.4	+0.6	84.8	+1.1	76.0	+0.1
20	84.6	+0.6	82.4	+0.2	85.9	+0.6	79.0	-0.2	81.8	0.0	86.5	+0.4	77.1	-0.5
30	85.8	+0.7	83.4	+0.2	87.1	+0.6	79.8	-0.1	82.9	+0.2	87.9	+0.7	78.0	-0.1
40	86.8	+0.6	84.4	+0.4	88.2	+0.7	80.5	0.0	83.9	+0.4	89.0	+0.7	78.8	0.0
50	87.8	+0.8	85.4	+0.6	89.4	+1.1	81.3	+0.3	85.1	+0.6	90.4	+0.9	79.8	+0.3
60	89.0	+0.9	86.4	+0.7	90.6	+0.9	82.1	+0.4	86.2	+0.6	91.8	+0.9	80.7	+0.4
70	90.1	+0.9	87.6	+0.9	92.1	+1.2	83.0	+0.6	87.3	+0.5	93.1	+0.7	81.6	+0.4
80	91.3	+0.8	88.6	+1.0	93.4	+1.2	83.8	+0.7	88.6	+0.8	94.6	+1.0	82.7	+0.7
90	93.1	+0.7	89.8	+0.8	94.8	+0.9	84.8	+0.6	90.6	+1.3	96.8	+1.5	84.3	+1.0
95	94.2	+0.4	91.6	+0.9	97.0	+1.2	86.2	+0.6	92.5	+1.8	98.8	+2.0	86.1	+1.5
98	95.7	+0.4	94.6	+1.4	100.2	+1.6	89.0	+1.2	-	-	-	-	-	-
99	97.8	+1.5	95.0	+1.1	100.6	+1.2	89.4	+0.9	-	-	-	-	-	-

TABLE VII

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL CARS

(For Knock-Sensor Cars, Maximum Octane Number Requirements Are Used)

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986
10	82.9	0.1	81.5	0.2	84.8	0.7	78.2	-0.3	80.7	-0.6	85.2	-0.2	76.2	-0.9
20	84.5	0.1	82.4	-0.2	85.9	0.1	79.0	-0.5	81.9	-0.5	86.6	-0.2	77.1	-0.8
30	85.5	-0.1	83.2	-0.5	86.9	-0.1	79.6	-0.7	83.0	-0.1	87.9	0.1	78.0	-0.5
40	86.4	-0.1	84.3	0.0	88.1	0.3	80.4	-0.3	84.0	0.1	89.1	0.3	78.8	-0.3
50	87.4	0.1	85.4	0.4	89.4	0.6	81.3	0.1	85.2	0.4	90.5	0.6	79.9	0.2
60	88.6	0.4	86.5	0.6	90.8	0.9	82.2	0.3	86.3	0.5	91.9	0.7	80.8	0.4
70	90.0	0.6	87.7	1.0	92.3	1.4	83.1	0.7	87.8	1.0	93.6	1.2	81.9	0.7
80	91.5	0.8	88.8	1.2	93.6	1.5	84.0	0.9	89.2	1.4	95.2	1.6	83.2	1.2
90	93.1	0.5	90.4	0.9	95.5	1.1	85.2	0.6	90.7	1.1	97.0	1.4	84.5	1.0
95	94.6	0.8	91.8	0.6	97.2	0.8	86.4	0.4	92.7	1.7	99.1	1.9	86.3	1.5
98	96.7	1.6	93.6	0.7	99.2	0.9	88.0	0.5	94.8	1.6	101.3	1.6	88.2	1.4
99	-	-	94.9	1.4	100.5	1.5	89.3	1.2	-	-	-	-	-	-

TABLE VIII

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL CARS

(For Knock-Sensor Cars, Minimum Octane Number Requirements Are Used)

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986
10	82.6	0.2	81.1	0.2	84.3	0.6	77.9	-0.2	80.4	-0.3	84.8	0.0	76.0	-0.7
20	84.4	0.2	82.3	-0.1	85.8	0.4	78.9	-0.4	81.7	-0.4	86.5	0.1	77.0	-0.7
30	85.5	0.1	83.2	-0.2	86.8	0.2	79.5	-0.6	82.8	-0.1	87.8	0.3	77.9	-0.4
40	86.4	0.0	84.1	0.0	87.9	0.3	80.3	-0.3	83.8	0.1	88.8	0.3	78.7	-0.2
50	87.3	0.2	85.1	0.3	89.1	0.6	81.2	0.1	85.0	0.5	90.3	0.8	79.7	0.2
60	88.5	0.5	86.2	0.6	90.4	0.9	82.0	0.4	86.1	0.7	91.6	0.9	80.6	0.4
70	89.8	0.7	87.4	1.0	92.0	1.4	82.9	0.7	87.3	0.8	93.1	1.0	81.6	0.7
80	91.0	0.7	88.5	1.2	93.3	1.6	83.8	1.0	88.7	1.2	94.7	1.5	82.7	0.9
90	92.8	0.6	89.9	1.0	95.0	1.3	84.9	0.8	90.4	1.3	96.6	1.5	84.2	1.1
95	93.8	0.3	91.3	0.6	96.6	0.8	86.0	0.4	92.1	1.5	98.4	1.6	85.7	1.2
98	95.9	1.0	93.2	0.3	98.8	0.5	87.6	0.1	94.4	1.2	100.9	1.2	87.9	1.2
99	98.8	3.2	94.4	0.9	100.0	1.0	88.8	0.7	-	-	-	-	-	-

TABLE IX

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL TRUCKS AND VANS

(For Knock-Sensor Trucks and Vans, Maximum Octane Number Requirements Are Used)

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1987	Δ from 1986*	1987	Δ from 1986*	1987	Δ from 1986*	1987	Δ from 1986*	1987	Δ from 1986*	1987	Δ from 1986*	1987	Δ from 1986*
10	83.0	-0.5	81.1	-1.0	84.3	-0.8	77.9	-1.1	80.8	-0.2	85.3	0.0	76.3	-0.5
20	85.6	-0.1	83.4	-0.2	87.1	-0.5	79.8	-0.6	82.5	+0.1	87.4	+0.6	77.6	-0.2
30	87.0	0.0	84.3	-0.4	88.1	-0.7	80.4	-0.3	83.7	+0.1	88.7	+0.1	78.6	0.0
40	88.0	-0.3	85.3	-0.3	89.4	-0.7	81.3	0.0	85.0	-0.1	90.2	-0.9	79.7	0.4
50	89.2	-0.1	86.3	-0.3	90.5	-0.5	82.0	-0.2	86.0	-0.2	91.5	-0.5	80.6	0.3
60	90.2	0.1	87.2	-0.3	91.7	-0.2	82.7	-0.6	86.8	-0.1	92.4	-0.3	81.2	-0.1
70	91.2	0.0	88.3	0.0	93.0	-0.3	83.6	-0.1	87.6	0.0	93.4	0.0	81.8	-0.1
80	92.2	0.1	88.9	-0.3	93.8	-0.1	84.0	-0.3	88.8	0.0	94.8	0.1	82.8	-0.1
90	94.0	0.1	91.6	+1.3	97.0	+1.7	86.3	+1.0	92.2	+1.7	98.5	+1.8	85.8	+1.4
95	95.6	-0.1	94.7	+3.5	100.3	+5.0	89.1	+3.1	-	-	-	-	-	-
98	97.8	0.3	95.4	-	101.0	-	89.8	-	-	-	-	-	-	-
99	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*1986 Maximum Octane Number Requirements estimated from CRC Report No. 553, "1986 CRC Octane Number Requirement Survey."

TABLE X

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL TRUCKS AND VANS

(For Knock-Sensor Trucks and Vans, Minimum Octane Number Requirements Are Used)

	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
Percent Satisfied	1987	Δ from* 1986	1987	Δ from* 1986	1987	Δ from* 1986	1987	Δ from* 1986	1987	Δ from* 1986	1987	Δ from* 1986	1987	Δ from* 1986
10	82.8	1.5	80.9	3.2	84.1	4.1	77.8	2.4	80.4	4.8	84.8	6.2	76.0	3.5
20	85.3	2.3	83.1	2.9	86.7	3.7	79.5	2.1	82.0	4.1	86.8	5.2	77.3	3.1
30	86.9	2.8	84.1	2.1	87.8	2.8	80.3	1.3	83.2	3.3	88.1	4.1	78.2	2.4
40	87.9	3.0	85.0	1.8	88.9	2.7	81.0	1.8	84.2	2.2	89.4	2.6	79.1	1.9
50	89.0	2.3	85.8	0.1	89.9	-0.1	81.6	0.2	85.5	1.0	90.8	1.3	80.1	0.6
60	89.8	0.8	86.6	-0.2	91.0	-0.2	82.3	-0.1	86.6	-0.3	92.2	-0.3	81.0	-0.3
70	90.6	0.4	88.1	0.1	92.7	0.4	83.4	-0.2	87.3	-0.7	93.0	-1.0	81.5	-0.5
80	91.6	0.4	88.7	-0.1	93.5	0.2	83.9	2.7	88.4	-0.4	94.4	-0.2	82.5	-0.5
90	93.7	0.9	90.0	0.1	95.0	0.2	84.9	-0.1	91.4	1.4	97.7	1.6	85.1	1.1
95	94.4	-0.8	91.5	0.0	96.7	0.9	86.2	-1.0	-	-	-	-	-	-
98	95.0	-2.0	92.9	-0.9	98.3	-0.2	87.5	-1.5	-	-	-	-	-	-
99	96.0	-2.3	93.8	-0.8	99.3	0.2	88.4	-1.6	-	-	-	-	-	-

*1986 Maximum Octane Number Requirements estimated from CRC Report No. 553, "1986 CRC Octane Number Requirement Survey."

TABLE XI

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL KNOCK-SENSOR VEHICLES

(Maximum Octane Number Requirements Are Used)

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986
10	82.0	1.8	80.1	1.3	83.1	1.8	77.1	0.8	79.9	1.0	84.1	1.4	75.6	0.5
20	84.2	0.2	82.3	0.0	85.8	0.5	78.9	-0.3	81.4	-0.3	86.1	0.2	76.8	-0.6
30	85.8	0.3	83.9	0.4	87.6	0.7	80.1	-0.1	83.1	0.2	88.0	0.5	78.1	-0.2
40	87.8	0.9	85.3	1.0	89.3	1.4	81.3	0.6	84.7	0.6	90.0	1.0	79.5	0.3
50	89.0	0.8	86.6	1.2	90.9	1.6	82.2	0.7	86.1	0.7	91.6	1.0	80.6	0.5
60	90.3	1.1	87.7	1.4	92.2	1.8	83.1	1.0	87.0	0.7	92.7	0.9	81.3	0.5
70	91.3	1.1	88.6	1.2	93.4	1.6	83.8	0.9	88.3	1.0	94.2	1.2	82.4	0.8
80	92.4	0.8	89.7	1.1	94.7	1.4	84.7	0.9	89.8	1.2	95.8	1.3	83.7	1.0
90	94.6	1.2	91.9	1.7	97.3	2.1	86.5	1.3	92.6	2.5	99.0	2.8	86.2	2.2
95	96.2	2.0	93.3	2.5	98.9	2.9	87.7	2.0	94.4	3.6	100.9	4.0	87.9	3.3
98	-	-	-	-	-	-	-	-	-	-	-	-	-	-
99	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE XII

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 TOTAL KNOCK-SENSOR VEHICLES

(Minimum Octane Number Requirements Are Used)

Percent Satisfied	PR Fuels		FBRU Fuels						FBRSU Fuels					
			(R+M)/2		RON		MON		(R+M)/2		RON		MON	
	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986	1987	Δ from 1986
10	81.2	3.4	79.1	2.6	81.9	3.2	76.3	2.0	78.2	1.8	82.2	2.5	74.2	1.2
20	83.4	1.6	81.5	1.5	84.7	2.1	78.2	0.8	80.8	1.8	85.3	2.5	76.3	1.1
30	85.4	2.0	83.1	1.3	86.7	1.9	79.5	0.7	82.1	1.2	86.9	1.9	77.3	0.5
40	87.6	3.0	84.5	1.7	88.3	2.3	80.6	1.0	83.5	1.5	88.5	2.2	78.4	0.7
50	88.8	2.9	85.5	2.1	89.6	2.8	81.4	1.3	85.0	2.1	90.3	2.8	79.7	1.4
60	89.6	2.5	86.6	2.4	90.9	3.2	82.2	1.6	86.3	2.4	91.8	3.0	80.8	1.7
70	90.4	1.9	88.1	2.5	92.7	3.2	83.4	1.8	87.2	1.9	92.9	2.3	81.5	1.4
80	91.4	1.8	88.8	1.7	93.6	2.2	83.9	1.2	88.3	1.0	94.2	1.2	82.4	0.8
90	93.2	1.6	89.9	1.3	94.9	1.5	84.9	1.0	91.0	2.3	97.3	2.7	84.8	2.0
95	94.8	1.5	91.7	2.2	97.1	2.7	86.3	1.7	92.8	3.0	99.2	3.3	86.3	2.6
98	97.3	3.1	93.4	3.2	99.0	3.8	87.8	2.6	94.6	4.2	101.1	4.6	88.1	3.8
99	-	-	-	-	-	-	-	-	95.2	4.4	101.8	4.9	88.6	4.0

TABLE XIII

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

SELECT MODEL: NAR T25A3/HAR T25A3/IAR T25A3/LAR T25A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	83.9	88.5	80.6	84.6	89.8	79.0	84.4
10	84.8	89.7	81.4	85.5	91.0	80.0	85.5
20	85.9	91.1	82.3	86.7	92.5	81.2	86.9
30	86.7	92.1	83.0	87.5	93.6	82.0	87.8
40	87.4	92.9	83.6	88.2	94.5	82.8	88.7
50	88.0	93.7	84.1	88.9	95.4	83.4	89.4
60	88.6	94.5	84.6	89.6	96.3	84.1	90.2
70	89.3	95.4	85.2	90.3	97.2	84.8	91.0
80	90.1	96.4	85.9	91.1	98.3	85.7	92.0
90	91.2	97.7	86.8	92.3	99.8	86.9	93.3
95	92.1	98.9	87.6	93.2	101.0	87.8	94.4
N	17	17	17	17	17	17	17
Mean	88.0	93.7	84.1	88.9	95.4	83.4	89.4
Std. Dev.	2.5	3.1	2.1	2.6	3.4	2.7	3.1

TABLE XIV

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

SELECT MODEL: NJ1 T20A3/LJ1 T20A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	82.8	85.1	78.5	81.8	86.3	76.9	81.6
10	83.7	86.0	79.1	82.6	87.3	77.6	82.4
20	84.8	87.1	79.8	83.4	88.4	78.4	83.4
30	85.5	87.8	80.3	84.0	89.3	79.0	84.1
40	86.2	88.5	80.7	84.6	90.0	79.5	84.8
50	86.8	89.1	81.1	85.1	90.7	80.0	85.3
60	87.5	89.7	81.5	85.6	91.4	80.5	85.9
70	88.1	90.3	81.9	86.1	92.1	81.0	86.5
80	88.9	91.1	82.4	86.7	92.9	81.6	87.3
90	90.0	92.1	83.0	87.6	94.1	82.4	88.3
95	90.9	93.)	83.6	88.3	95.1	83.1	89.1
N	13	13	13	13	13	13	13
Mean	86.8	89.1	81.1	85.1	90.7	80.0	85.3
Std. Dev.	2.5	2.4	1.5	2.0	2.7	1.9	2.3

TABLE XV

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

Knock Sensor Select Model - High Borderline

SELECT MODEL: NAW P28A3/HAW P28A3/IAW P28A3/LAW P28A3/NJW P28A3/GJW P28A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	79.6	84.2	77.8	81.0	83.2	74.5	78.8
10	81.5	86.1	79.0	82.5	85.5	76.2	80.9
20	83.8	88.3	80.5	84.4	88.4	78.4	83.4
30	85.5	90.0	81.6	85.8	90.5	79.9	85.2
40	86.9	91.4	82.6	87.0	92.2	81.3	86.7
50	88.2	92.6	83.4	88.0	93.8	82.5	88.2
60	89.6	93.9	84.3	89.1	95.5	83.7	89.6
70	91.0	95.3	85.3	90.3	97.2	85.0	91.1
80	92.7	97.0	86.4	91.7	99.3	86.6	92.9
90	95.0	99.2	87.9	93.6	102.2	88.7	95.4
95	96.9	101.1	89.1	95.1	104.5	90.5	97.5
N	10	10	10	10	10	10	10
Mean	88.2	92.6	83.4	88.0	93.8	82.5	88.2
Std. Dev.	5.2	5.1	3.5	4.3	6.5	4.9	5.7

TABLE XV
(Continued)

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

Knock-Sensor Select Model - Low-Borderline
SELECT MODEL: NAW P28A3/HAW P28A3/IAW P28A3/NJW P28A3/GJW P28A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	79.1	83.0	76.9	79.9	82.6	74.1	78.3
10	81.1	84.9	78.3	81.6	85.0	75.8	80.4
20	83.4	87.4	79.9	83.6	87.8	78.0	82.9
30	85.1	89.1	81.1	85.1	89.9	79.5	84.7
40	86.5	90.6	82.1	86.3	91.7	80.8	86.2
50	87.8	91.9	83.0	87.5	93.3	82.1	87.7
60	89.2	93.3	83.9	88.6	94.9	83.3	89.1
70	90.6	94.8	84.9	89.9	96.7	84.6	90.7
80	92.3	96.5	86.1	91.3	98.8	86.2	92.5
90	94.6	99.0	87.7	93.3	101.6	88.3	95.0
95	96.6	100.9	89.1	95.0	104.0	90.1	97.0
N	10	10	10	10	10	10	10
Mean	87.8	91.9	83.0	87.5	93.3	82.1	87.7
Std. Dev.	5.3	5.5	3.7	4.6	6.5	4.9	5.7

TABLE XVI

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

Knock-Sensor Select Model - High-Borderline
SELECT MODEL: IH3 P38A4/IC3 P38A4/HH3 P38A4/LH3 P38A4/LC3 P38A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	76.8	83.7	77.5	80.6	82.0	73.9	78.0
10	78.7	85.0	78.4	81.7	83.8	75.1	79.5
20	81.0	86.5	79.4	83.0	85.9	76.7	81.3
30	82.7	87.7	80.2	83.9	87.5	77.8	82.6
40	84.2	88.7	80.8	84.7	88.8	78.7	83.7
50	85.5	89.6	81.4	85.5	90.0	79.6	84.8
60	86.8	90.5	82.0	86.2	91.3	80.4	85.8
70	88.3	91.5	82.6	87.0	92.6	81.4	87.0
80	90.0	92.6	83.4	88.0	94.1	82.5	88.3
90	92.3	94.2	84.4	89.3	96.3	84.0	90.1
95	94.2	95.5	85.2	90.4	98.0	85.2	91.6
N	15	15	15	15	15	15	15
Mean	85.5	89.6	81.4	85.5	90.0	79.6	84.8
Std. Dev.	5.3	3.6	2.3	3.0	4.9	3.4	4.1

TABLE XVI
(Continued)

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODEL

Knock-Sensor Select Model - Low-Borderline
SELECT MODEL: IH3 P38A4/IC3 P38A4/HH3 P38A4/LH3 P38A4/LC3 P38A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	76.4	81.6	76.1	78.9	80.1	72.7	76.4
10	78.2	83.0	77.1	80.0	82.0	74.0	78.0
20	80.4	84.7	78.2	81.4	84.3	75.6	79.9
30	82.0	85.9	79.0	82.4	85.9	76.7	81.3
40	83.4	87.0	79.7	83.3	87.4	77.7	82.5
50	84.7	87.9	80.3	84.1	88.7	78.6	83.7
60	85.9	88.9	80.9	84.9	90.0	79.6	84.8
70	87.3	90.0	81.6	85.8	91.4	80.5	86.0
80	88.9	91.2	82.4	86.8	93.0	81.7	87.4
90	91.1	92.9	83.6	88.2	95.3	83.3	89.3
95	92.9	94.3	84.5	89.4	97.2	84.6	90.9
N	15	15	15	15	15	15	15
Mean	84.7	87.9	80.3	84.1	88.7	78.6	83.7
Std. Dev.	5.0	3.9	2.5	3.2	5.2	3.6	4.4

TABLE XVII

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

SELECT MODEL: PED T22A3/PKD T22A3/PPD T22A3/KKD T22A3/KPD T22A3/DHD T22A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	82.2	83.0	77.1	80.1	82.9	74.6	78.7
10	83.2	84.3	77.9	81.1	84.3	75.6	79.9
20	84.5	85.7	78.9	82.3	86.0	76.7	81.4
30	85.4	86.8	79.6	83.2	87.2	77.6	82.4
40	86.2	87.7	80.2	83.9	88.3	78.3	83.3
50	86.9	88.5	80.7	84.6	89.3	79.0	84.2
60	87.6	89.4	81.3	85.3	90.3	79.7	85.0
70	88.4	90.3	81.9	86.1	91.4	80.5	85.9
80	89.3	91.4	82.6	87.0	92.6	81.3	87.0
90	90.6	92.8	83.5	88.2	94.3	82.5	88.5
95	91.6	94.1	84.3	89.2	95.7	83.5	89.6
N	10	10	10	10	10	10	10
Mean	86.9	88.5	80.7	84.6	89.3	79.0	84.2
Std. Dev.	2.9	3.4	2.2	2.8	3.9	2.7	3.3

TABLE XVIII

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

SELECT MODEL: 0E9 TI9A3/ME9 T19A3

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	84.4	84.9	78.3	81.6	86.8	77.3	82.1
10	85.8	86.3	79.2	82.7	87.9	78.0	83.0
20	87.4	87.9	80.3	84.1	89.2	79.0	84.1
30	88.6	89.1	81.0	85.1	90.2	79.6	84.9
40	89.6	90.1	81.7	85.9	91.0	80.2	85.6
50	90.6	91.0	82.3	86.7	91.7	80.7	86.2
60	91.5	91.9	82.9	87.4	92.5	81.2	86.9
70	92.5	92.9	83.6	88.3	93.3	81.8	87.6
80	93.7	94.1	84.3	89.2	94.3	82.5	88.4
90	95.4	95.7	85.4	90.6	95.6	83.4	89.5
95	96.7	97.1	86.3	91.7	96.7	84.1	90.4
N	12	12	12	12	12	12	12
Mean	90.6	91.0	82.3	86.7	91.7	80.7	86.2
Std. Dev.	3.7	3.7	2.4	3.1	3.0	2.1	2.5

TABLE XIX

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

SELECT MODEL: OPF P50A4/OSF P50A4/MPF P50A4/MSF P50A4/SPF P50A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	80.1	80.8	75.6	78.2	80.9	73.3	77.1
10	81.6	82.2	76.5	79.4	82.4	74.3	78.4
20	83.5	83.9	77.6	80.8	84.3	75.6	79.9
30	84.9	85.1	78.5	81.1	85.6	76.5	81.0
40	86.0	86.2	79.1	82.7	86.7	77.2	82.0
50	87.1	87.2	79.8	83.5	87.7	78.0	82.9
60	88.2	88.1	80.4	84.3	88.8	78.7	83.7
70	89.4	89.2	81.1	85.2	89.9	79.4	84.7
80	90.7	90.4	81.9	86.2	91.2	80.4	85.8
90	92.6	92.1	83.1	87.6	93.1	81.6	87.3
95	94.2	93.5	84.0	88.7	94.6	82.6	88.6
N	12	12	12	12	12	12	12
Mean	87.1	87.2	79.8	83.5	87.7	78.0	82.9
Std. Dev.	4.3	3.9	2.6	3.2	4.1	2.8	3.5

TABLE XX

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

Knock-Sensor Select Model - High-Borderline
SELECT MODEL: ORU P30A4/MRU P30A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	87.7	87.6	80.0	83.8	88.0	78.0	83.0
10	88.6	88.7	80.7	84.7	89.2	78.9	84.0
20	89.6	90.0	81.6	85.8	90.7	79.9	85.3
30	90.3	91.0	82.3	86.6	91.7	80.7	86.2
40	91.0	91.8	82.8	87.3	92.6	81.4	87.0
50	91.6	92.6	83.3	87.9	93.5	82.0	87.7
60	92.2	93.3	83.8	88.6	94.3	82.6	88.4
70	92.8	94.1	84.4	89.3	95.2	83.2	89.2
80	93.6	95.1	85.0	90.1	96.3	84.0	90.1
90	94.6	96.4	85.9	91.2	97.7	85.1	91.4
95	95.5	97.6	86.6	92.1	98.9	86.0	92.5
N	17	17	17	17	17	17	17
Mean	91.6	92.6	83.3	87.9	93.5	82.0	87.7
Std. Dev.	2.4	3.0	2.0	2.5	3.3	2.4	2.9

TABLE XX
(Continued)

MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

Knock-Sensor Select Model - Low-Borderline
SELECT MODEL: ORU P30A4/MRU P30A4

Percent Satisfied	PR ON	FBRU			FBRSU		
		RON	MON	(R+M)/2	RON	MON	(R+M)/2
5	86.6	86.2	79.2	82.7	86.6	77.0	81 8
10	87.4	87.3	79.9	83.6	87.8	77.9	82.9
20	88.4	88.6	80.8	84.7	89.3	78.9	84.1
30	89.1	89.6	81.4	85.5	90.3	79.7	85.0
40	89.8	90.4	81.9	86.1	91.2	80.3	85.8
50	90.4	91.1	82.4	86.8	92.0	80.9	86.5
60	90.9	91.9	82.9	87.4	92.9	81.5	87.2
70	91.6	92.7	83.4	88.1	93.8	82.2	88.0
80	92.3	93.7	84.1	88.9	94.8	82.9	88.9
90	93.3	95.0	84.9	90.0	96.3	84.0	90.1
95	94.2	96.1	85.6	90.9	97.5	84.8	91.1
N	17	17	17	17	17	17	17
Mean	90.4	91.1	82.4	86.8	92.0	80.9	86.5
Std. Dev.	2.3	3.0	2.0	2.5	3.3	2.4	2.9

TABLE XXI

OWNER/RATER COMPARISON OF TANK FUEL KNOCK

(1980-1987 CRC Octane Number Requirement Surveys)

Model Year:	1987	1986	1985	1984	1983	1982	1981	1980
Fuel:	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded	Unleaded
Total Reports:	179	160	143	149	129	144	149	218
Percent Knocking								
Trained Rater	39.7	33.1	37.8	51.7	59.7	47.9	43.6	51.1
Owner	24.0	16.3	18.9	26.2	29.5	25.0	29.5	31.2
Owner/Rater Ratio	0.61	0.49	0.50	0.51	0.49	0.52	0.68	0.61
Percent Owners Objecting								
Based on: Total Reports	2.8	2.5	9.8	7.4	12.4	13.2	12.1	15.1
Owners Reporting Knock	11.6	15.4	51.9	28.2	42.1	52.8	40.9	48.5

* Some vehicles were designed for leaded fuels.

TABLE XXII

TANK-FUEL KNOCK REPORTED BY TRAINED OBSERVERS

I. Total Vehicles

Model Year	No. Survey	Vehicles Tested on Tank Fuel	
		No. Tested	% Knocking (Wtg. Avg.)
1987	389	322	35.0
1986	377	330	31.1
1985	374	327	36.9
1984	407	358	49.3
1983	383	314	44.6
1982	434	342	41.6
1981	417	326	42.9
1980	429	374	49.9

II. 1987 Select Models	No. in Survey	No. Tested	% Knocking
NAR T25A3/HAR T25A3/ IAR T25A3/LAR T25A3	17	15	73
NJ1 T20A3/LJI T20A3	13	11	18
NAW P28A3/HAW P28A3/ IAW P28A3/LAW P28A3/ NJW P28A3/GJW P28A3	10	10	60
IH3 P38A4/IC3 P38A4/ HH3 P38A4/LH3 P38A4/ LC3 P38A4	15	13	23
PED T22A3/PKD T22A3/ PPD T22A3/KKD T22A3/ KPD T22A3/DHD T22A3	10	8	50
OE9 T19A3/MED T19A3	12	12	33
OPF P50A4/OSF P50A4/ MPF P50A4/MSF P50A4/ SPF P50A4	12	10	10
ORU P30A4/MRU P30A4	17	15	60

TABLE XXIII

ENGINE SPEEDS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

Percent of Cars Having Maximum Requirements Within Specified Speed (rpm) Ranges

SPEED RANGE	Model:	NAR T25A3/HAR T25A3/IAR T25A3/ LAR T25A3			NJ1 T20A3/LJ1 T20A3			NAW P28A3/HAW P28A3/ IAW P28A3/LAW P28A3/ NJW P28A3/GJW P28A3/ Knock Sensor, Maximum (High-Borderline)		
	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU	PR	FBRU	FBRSU
1599 and Lower		26	40	33	0	28	27	0	0	0
1600 - 1999		7	0	7	9	0	0	40	45	30
2000 - 2399		20	13	7	0	27	9	30	11	30
2400 - 2799		27	40	39	64	18	27	10	11	20
2800 - 3199		13	0	7	27	27	37	20	11	10
3200 and Higher		7	7	7	0	0	0	0	22	10
No. of Cars		17			13			10		

SPEED RANGE	Model:	NAW P28A3/MAW P28A3/IAW P28A3 LAW P28A3/NJW P28A3/GJW P28A3 Knock Sensor, Minimum (Low-Borderline)			IM3 P38A4/IC3 P38A4/MM3 P38A4 LM3 P38A4/LC3 P38A4 Knock Sensor, Maximum (High-Borderline)			IM3 P38A4 IC3 P38A4/MM3 P38A4/ LM3 P38A4/LC3 P38A4/ Knock-Sensor, Minimum (Low-Borderline)		
	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU	PR	FBRU	FBRSU
1599 and Lower		0	0	0	31	30	50	30	31	43
1600 - 1999		40	45	40	23	31	30	31	46	29
2000 - 2399		30	11	20	31	31	14	31	15	21
2400 - 2799		10	11	20	15	8	0	8	0	0
2800 - 3199		20	11	10	0	0	0	0	8	7
3200 and Higher		0	22	10	0	0	0	0	0	0
No. of Cars		10			15			15		

TABLE XXIII
(Continued)

ENGINE SPEEDS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS - 1987 SELECT MODELS

Percent of Cars Having Maximum Requirements Within Specified Speed (rpm) Ranges

	Model:	PED T22A3/PKD T22A3 PPD T22A3/KKD T22A3 KPD T22A3/DMD T22A3			OE9 T19A3/ME9 T19A3			OPF P50A4 OSF P50A4/MPF P50A4 MSF P50A4/SPF P50A4		
SPEED RANGE	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU	PR	FBRU	FBRSU
1599 and Lower		0	10	20	59	67	67	75	58	75
1600 - 1999		0	20	0	33	25	25	17	17	0
2000 - 2399		50	40	40	8	0	0	8	17	25
2400 - 2799		30	10	20	0	0	8	0	8	0
2800 - 3199		20	10	10	0	8	0	0	0	0
3200 and Higher		0	10	10	0	0	0	0	0	0
No. of Cars		10			12			12		

	Model:	ORU P30A4/MRU P30A4 Knock-Sensor, Maximum (High-Borderline)			ORU P30A4/MRU P30A4 Knock-Sensor, Minimum (Low-Borderline)		
SPEED RANGE	Fuel:	PR	FBRU	FBRSU	PR	FBRU	FBRSU
1599 and Lower		76	76	70	76	65	47
1600 - 1999		18	18	12	18	29	29
2000 - 2399		0	0	6	0	0	12
2400 - 2799		6	0	12	0	0	6
2800 - 3199		0	6	0	6	0	0
3200 and Higher		0	0	0	0	6	6
No. of Cars		17					

TABLE XXIV

ENGINE SPEEDS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS

Weighted % of Vehicles Having Requirements in Indicated (rpm) Ranges

All 1987 Vehicles

Maximum Requirements Engine Speed Range	PR Fuels	FBRU Fuels	FBRSU Fuels
1599 and Lower	22.7	22.4	23.8
1600 - 1999	19.6	20.4	16.2
2000 - 2399	21.4	17.4	17.3
2400 - 2799	17.3	17.1	16.9
2800 - 3199	12.1	10.4	9.8
3200 - 3599	4.9	7.3	10.3
3600 and Higher	2.0	5.0	5.7

TABLE XXV

THROTTLE/GEAR POSITION FOR 1987 MAXIMUM FBRU OCTANE NUMBER REQUIREMENTS

Throttle Position	Transmission Type & Gear		No. of Vehicles*	% of Vehicles
	Automatic Transmission			
Maximum	4-Speed:	4th	54	17.4
		3rd	40	12.9
		2nd	21	6.8
	3-Speed:	3rd	73	23.5
		2nd	38	12.3
Part	4-Speed:	4th	21	6.8
		3rd	5	1.6
	3-Speed	3rd	50	16.1
		2nd	8	2.6
			310	100.0
	Manual Transmission			
Maximum	5-Speed:	4th	35	49.4
		3rd	4	5.6
	4-Speed:	4th	5	7.0
Part	5-Speed:	4th	20	28.2
	4-Speed:	4th	5	7.0
		3rd	2	2.8
			71	100.0

* Five test vehicles not counted, because all FBRU fuels satisfied their octane number requirements.

Three test vehicles not counted, because no FBRU fuels satisfied their octane number requirements.

Figure 1

DISTRIBUTION OF ODOMETER MILEAGE FOR 1987 MODEL VEHICLES TESTED

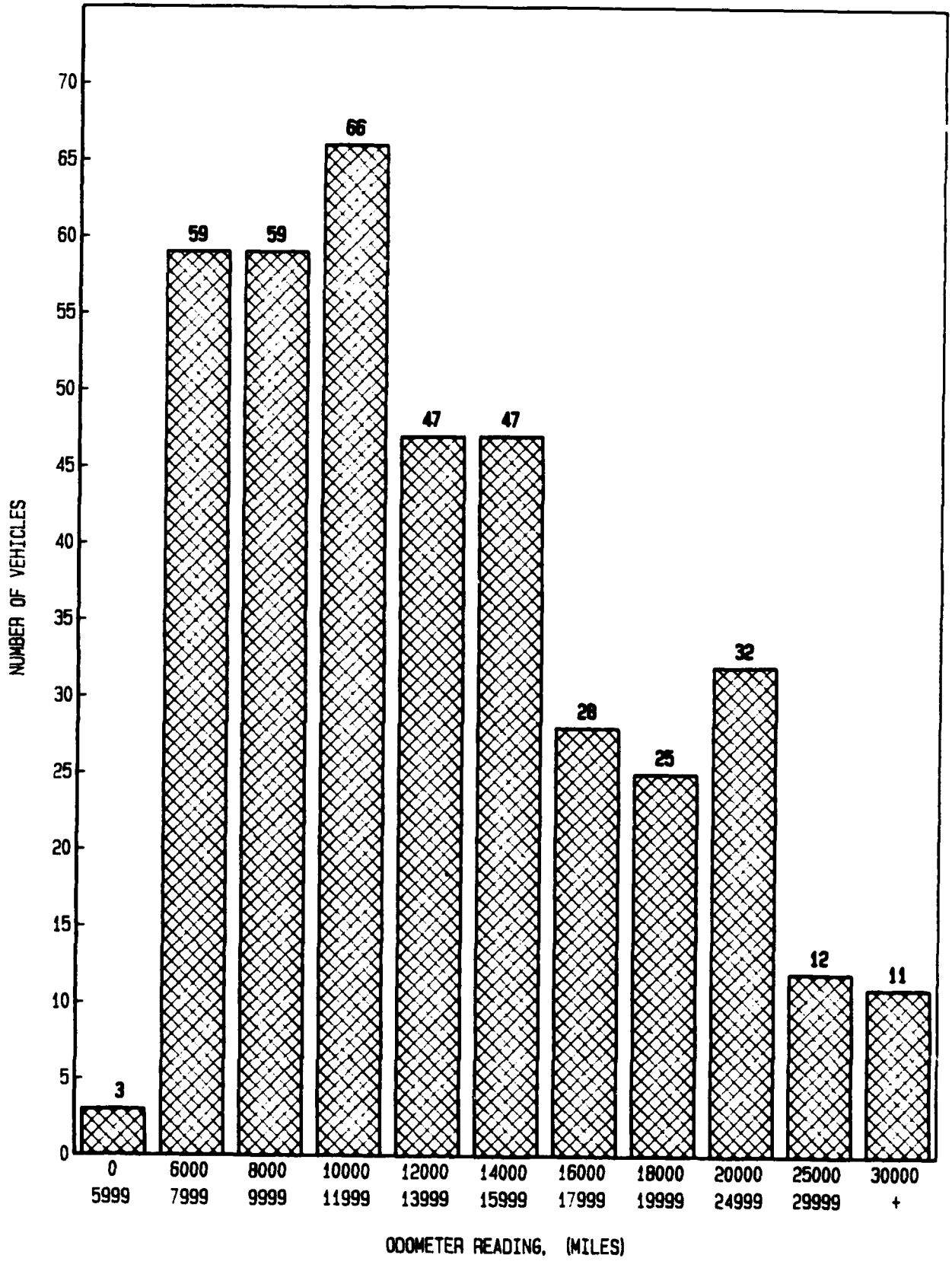


Figure 2
DISTRIBUTION OF MAXIMUM PR FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 TOTAL VEHICLES

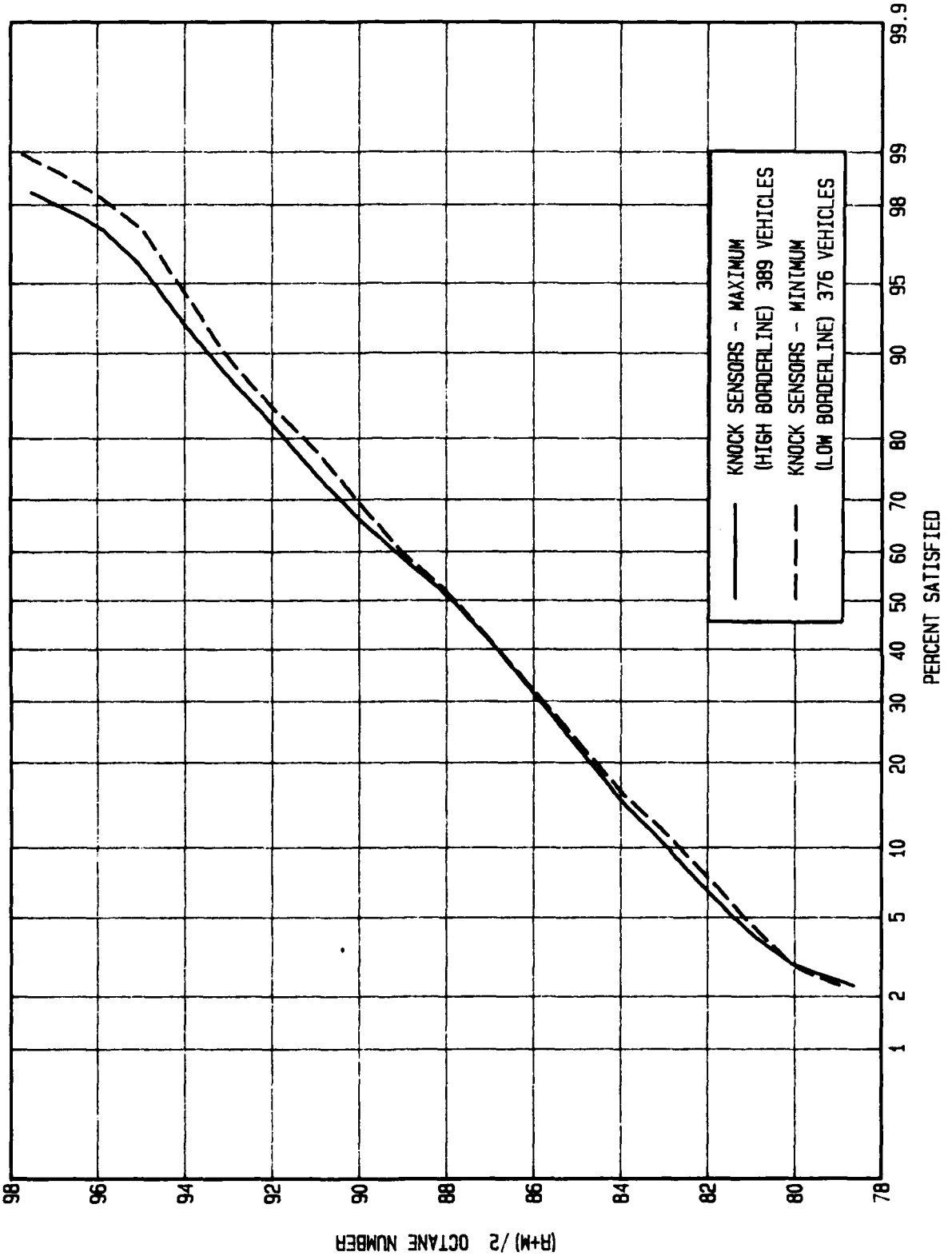


Figure 3
DISTRIBUTION OF MAXIMUM FBRU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 TOTAL VEHICLES

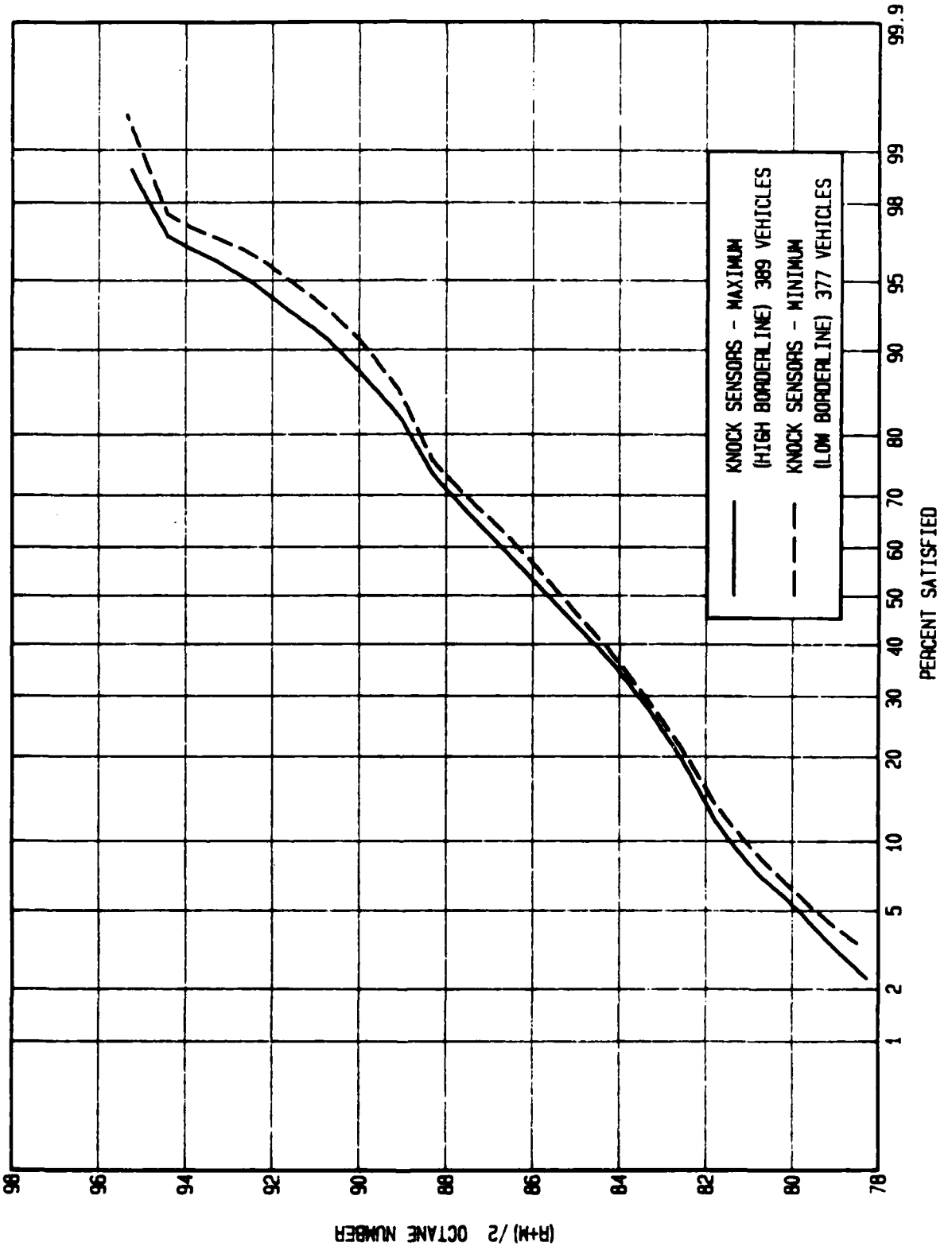


Figure 4
DISTRIBUTION OF MAXIMUM FBRSU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 TOTAL VEHICLES

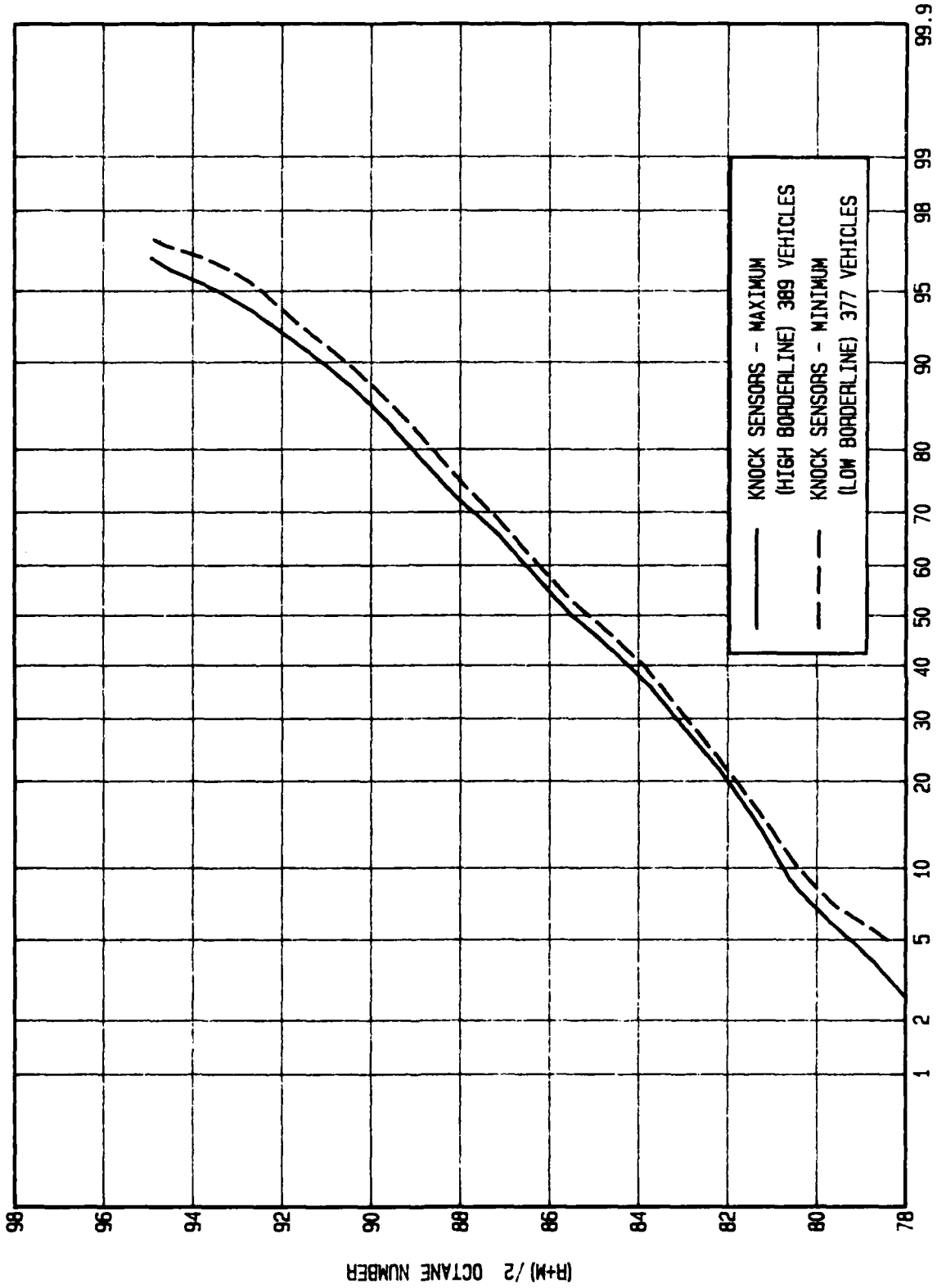


Figure 5
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 TOTAL VEHICLES

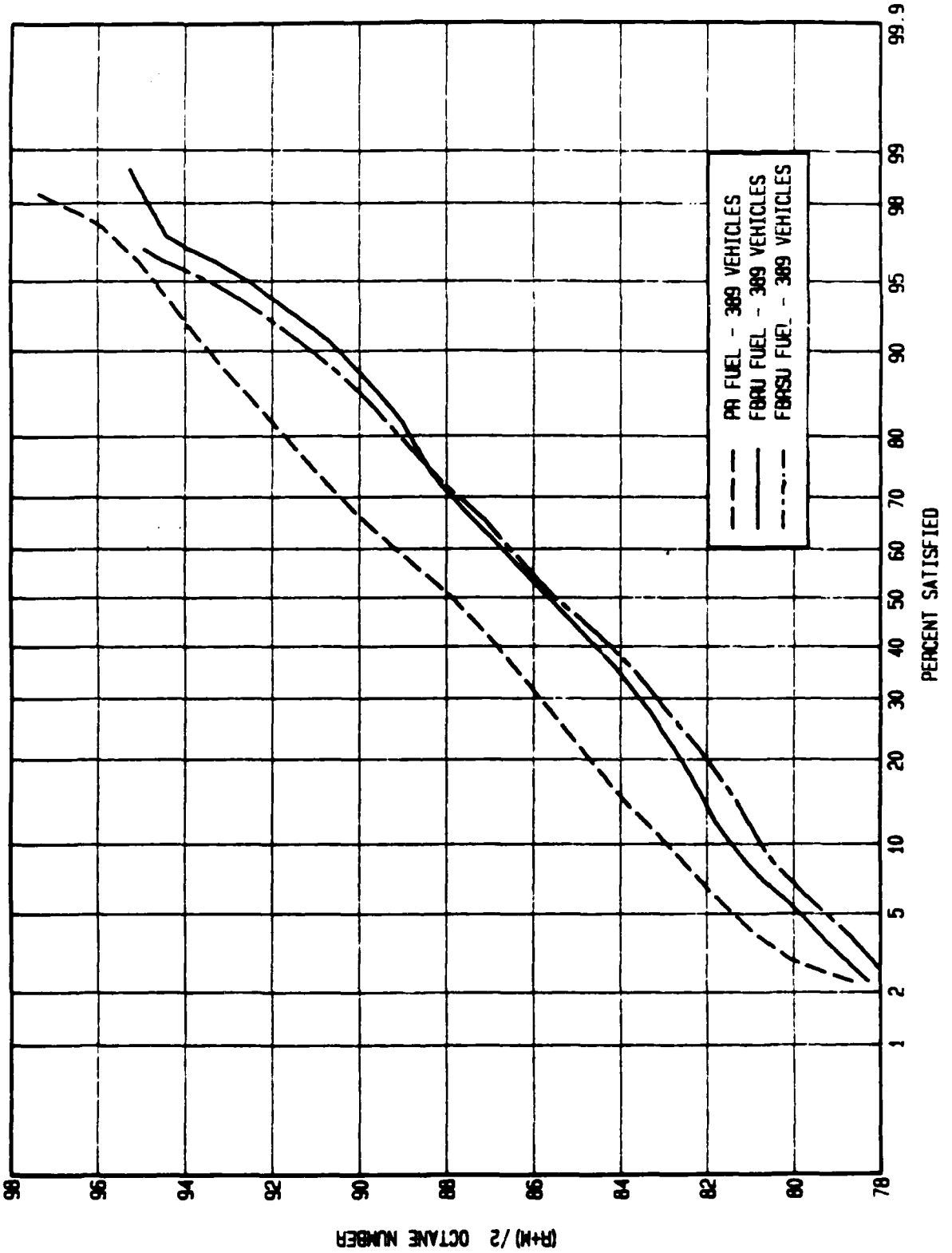


Figure 6
DISTRIBUTION OF MAXIMUM FBRU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 AND 1986 TOTAL VEHICLES

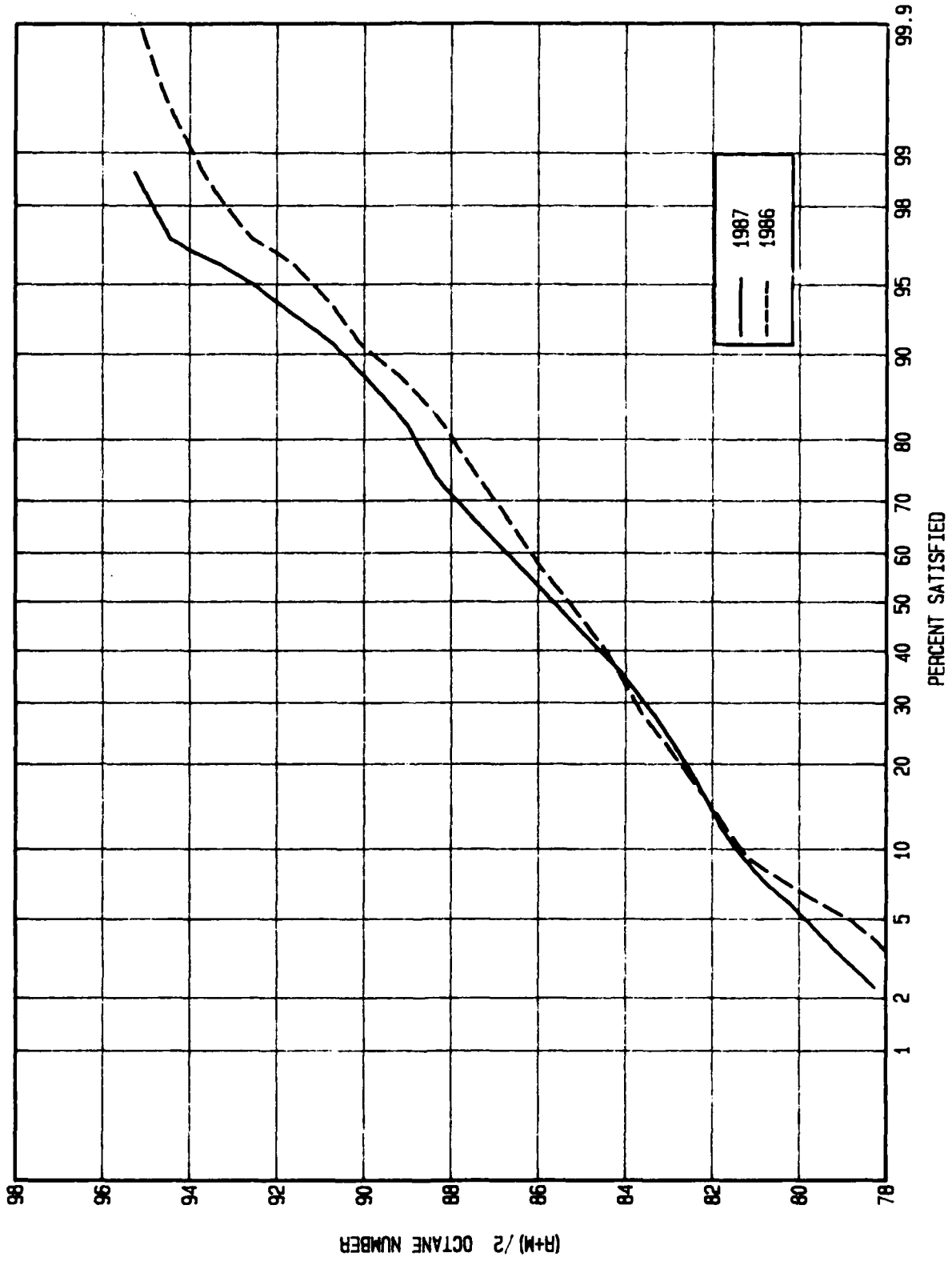


Figure 7
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 TOTAL CARS

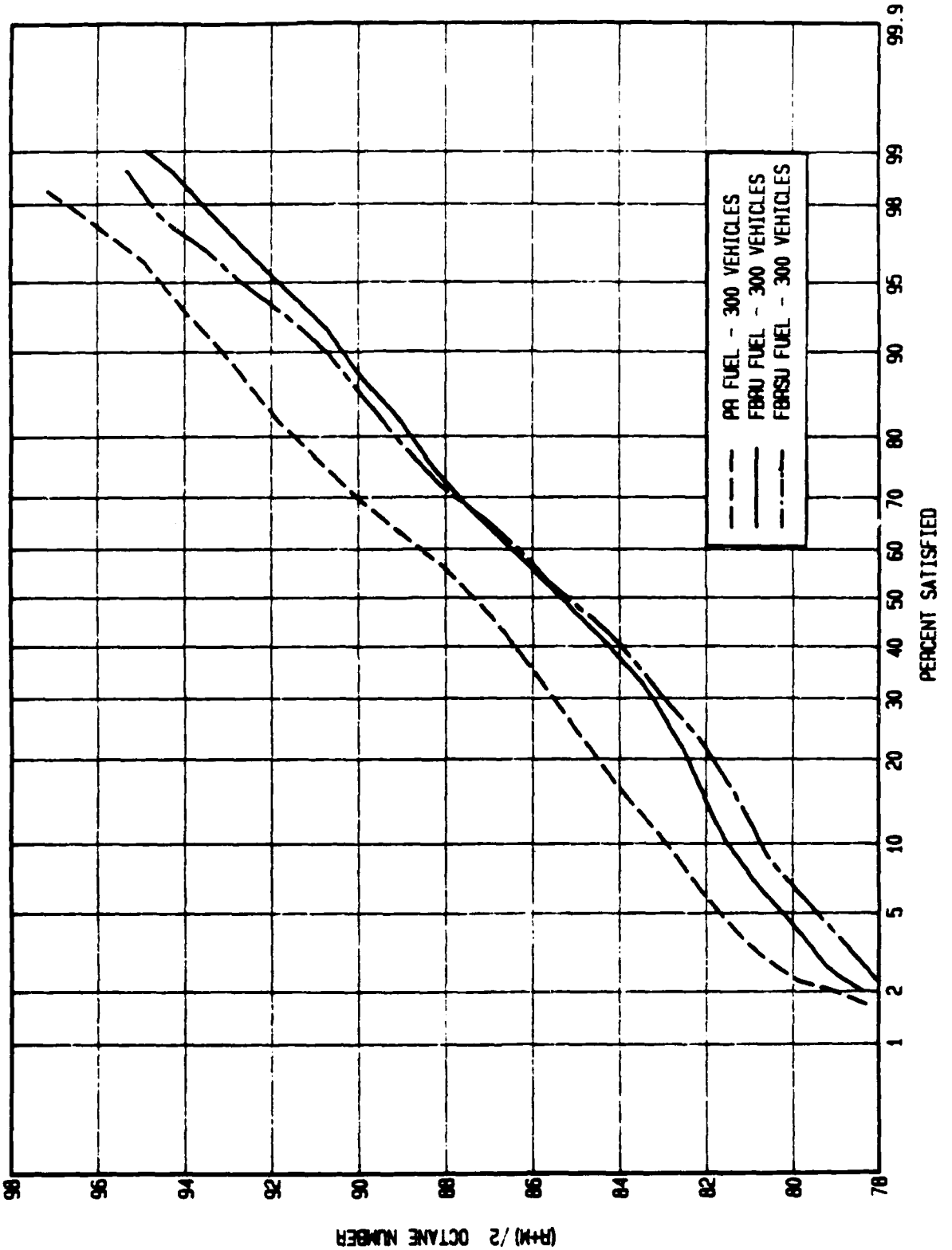


Figure 8
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 TOTAL TRUCKS AND VANS

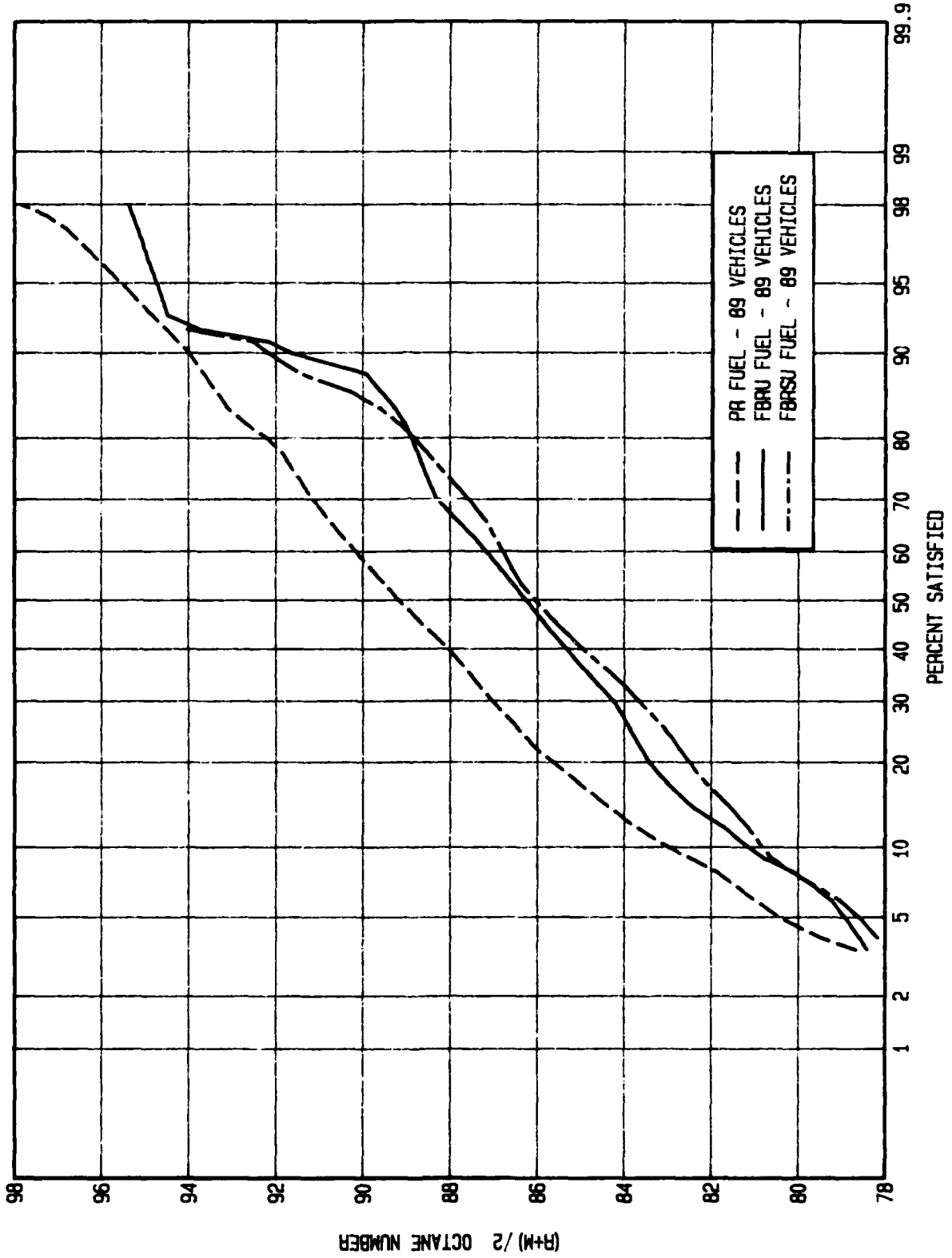


Figure 9
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 KNOCK SENSOR VEHICLES - MAXIMUM (HIGH BORDERLINE)

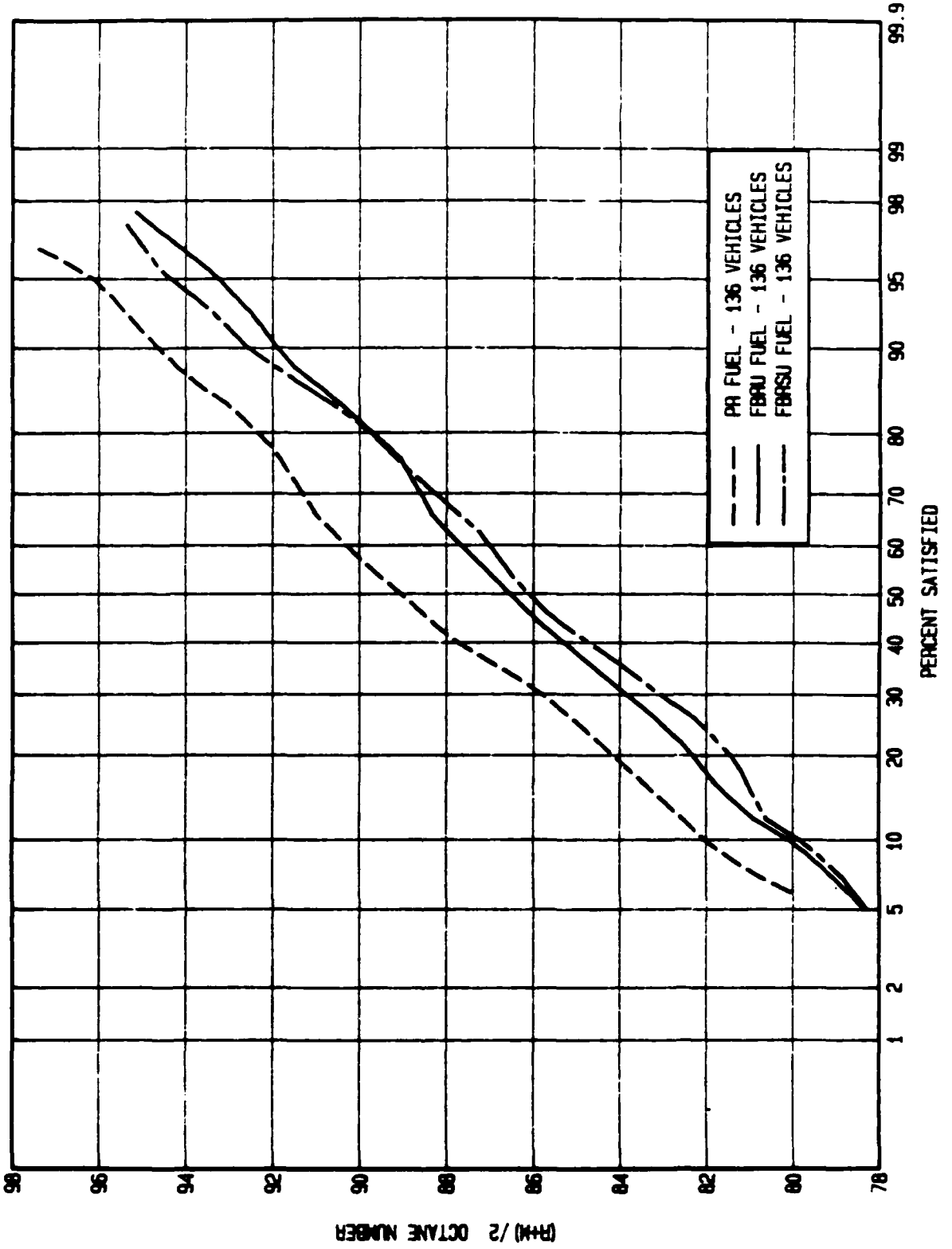


Figure 10
DISTRIBUTION OF MAXIMUM (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 KNOCK SENSOR VEHICLES - MINIMUM (LOW BORDERLINE)

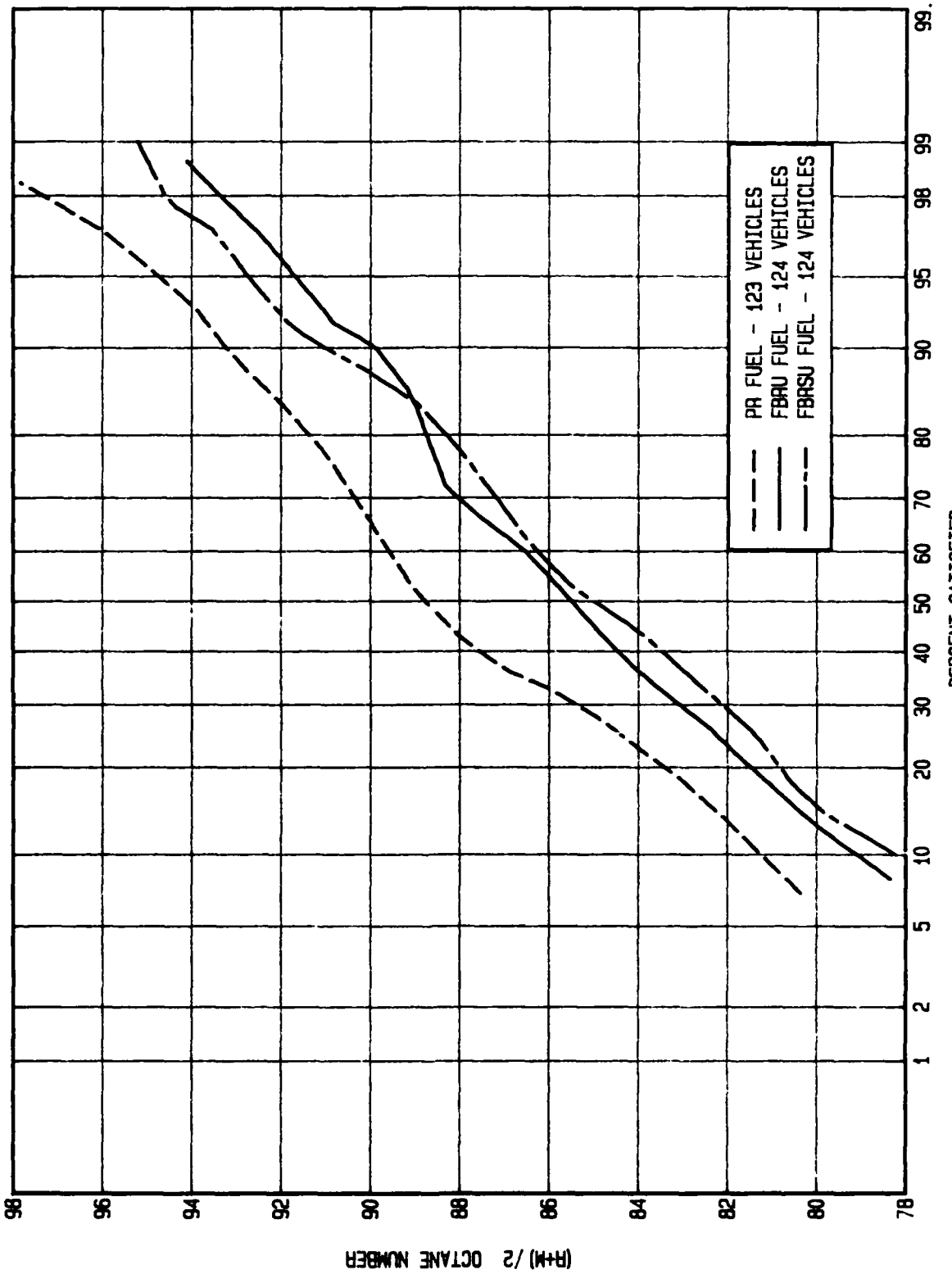
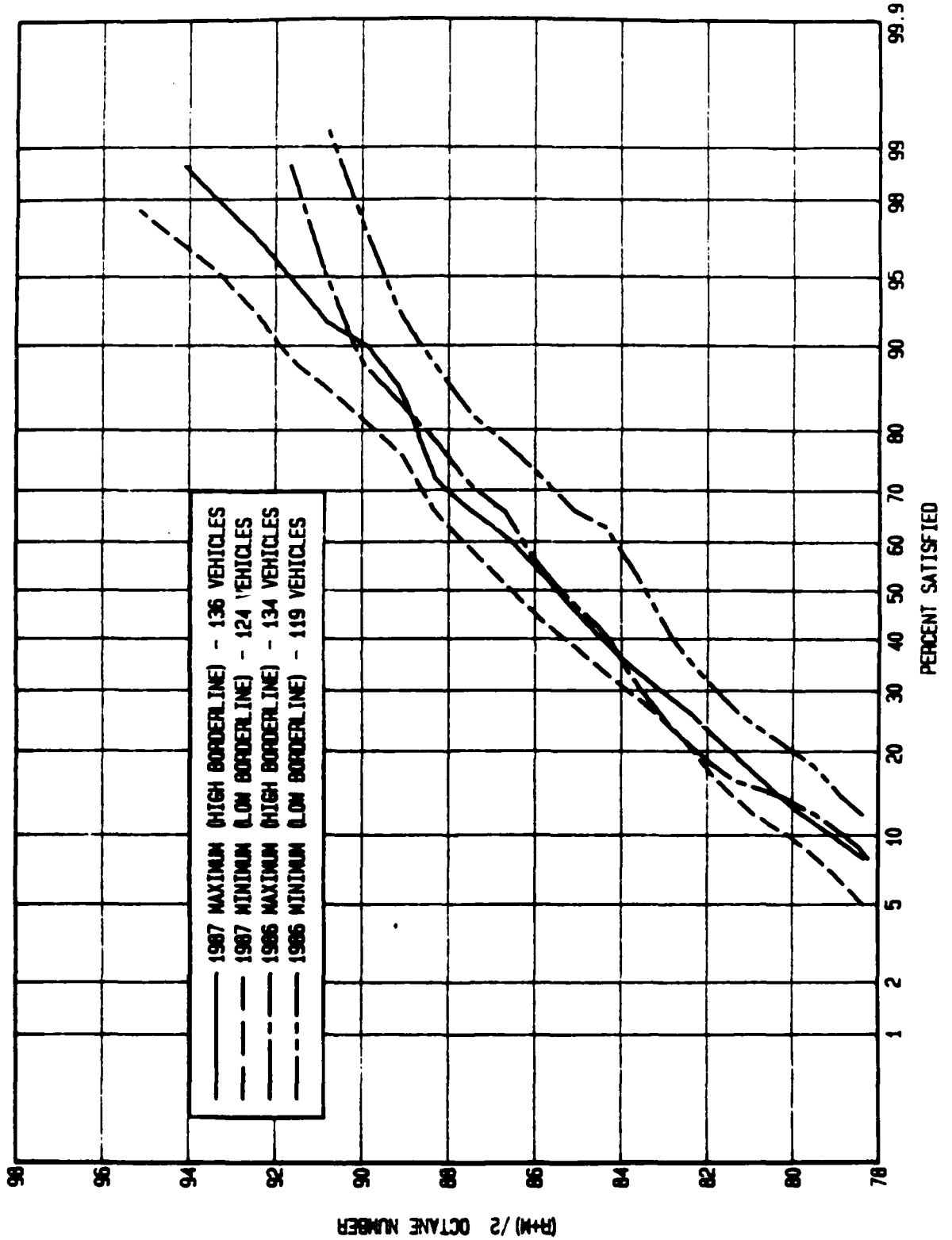


Figure 11
DISTRIBUTION OF MAXIMUM FBRU FUEL (R+M)/2 OCTANE NUMBER REQUIREMENTS
1987 AND 1986 KNOCK SENSOR VEHICLES



APPENDIX A

PARTICIPATING LABORATORIES

PARTICIPATING LABORATORIES

No. of Vehicles Tested	Eastern Area	East Central Area	No. of Vehicles Tested
29	Exxon Res. & Engrg. Co. Linden, NJ	Chrysler Corporation Detroit, Michigan	10
30	Mobil Res. & Dev. Corp. Paulsboro, NJ	Ford Motor Company Dearborn, MI	30
31	Sun Company Marcus Hook, PA	MMC Services Ann Arbor, MI	3
33	Texaco Inc. Beacon, NY	Nissan Res. & Dev. Ann Arbor, MI	10
		Petro-Canada Products Sheridan Park, Ontario	26
		Shell Canada Oakville, Ontario	15
		Standard Oil Co. Cleveland, OH	32
		Southwest Research Institute* San Antonio, Texas	12
		Toyota Motor Corp. Ann Arbor, MI	10
	Western Area	**West Central Area**	
30	Chevron Research Company Richmond, CA	Amoco Oil Company Naperville, IL	30
30	Unocal Corporation Brea, CA	Phillips Petroleum Co. Bartlesville, OK	21
		Shell Development Co. Houston, TX	7

*Industry-sponsored contract work.

APPENDIX B

MEMBERSHIP: 1987 ANALYSIS PANEL

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

1987 ANALYSIS PANEL

Name	Company
D. I. Hoel, Leader	Exxon Research and Engineering Company
W. F. Biller	Consultant
C. J. Bonés	Sun Refining and Marketing Company
P. W. Brigandi	Mobil Research and Development Corporation
J. C. Callison	Amoco Oil Company
J. P. Graham	Chevron Reseach Company
M. T. Noorman	Mobil Oil Corporation
T. Wusz	Unocal Corporation

APPENDIX C

DATA ON 1987/1988
FULL-BOILING RANGE REFERENCE FUELS

TABLE C-I

SUPPLIERS' FUEL INSPECTIONS

1987/1988 FBRU FUELS

	Low-Octane Base Blend RMFD 362-87/88	Intermediate-Octane Base Blend RMFD 363-87/88	High-Octane Base Blend RMFD 364-87/88
Laboratory Inspection			
Distillation, °F			
IBP	98	90	92
10% Evap.	137	124	122
30% Evap.	166	163	185
50% Evap.	192	214	237
70% Evap.	230	272	259
90% Evap.	333	353	294
End Point	413	421	388
RVP, psi	7.2	8.4	8.1
Lead, g/gal.	0.000	0.000	0.000
Oxidation Stab., min.	1440+	1440+	1440+
Hydrocarbon Type, Vol. %			
Aromatics	19.8	27.5	51.3
Olefins	13.8	9.6	0.0
Saturates	66.4	62.7	48.7
Research Octane Number	79.2	90.8	103.5
Motor Octane Number	74.7	82.6	91.8
Sensitivity	4.5	8.2	11.7

TABLE C-II

OCTANE NUMBERS AND COMPOSITIONS FOR 1987/1988 FBRU FUELS

Research Octane Number	Volume Percent RMFD 362-87/88	RMFD 363-87/88	RMFD 364-87/88	Motor Octane Number	Sensitivity
80	95.0	5.0	---	74.9	5.1
82	77.5	22.5	---	76.3	5.7
84	60.5	39.5	---	77.7	6.3
85	51.5	48.5	---	78.4	6.6
86	42.5	57.5	---	79.0	7.0
87	34.0	66.0	---	79.7	7.3
88	25.0	75.0	---	80.4	7.6
89	16.5	83.5	---	81.1	7.9
90	7.5	92.5	---	81.7	8.3
91	---	99.5	0.5	82.3	8.7
92	---	92.5	7.5	82.9	9.1
93	---	85.5	14.5	83.6	9.4
94	---	78.0	22.0	84.2	9.8
95	---	70.0	30.0	84.9	10.1
96	---	62.5	37.5	85.6	10.4
97	---	54.5	45.5	86.3	10.7
98	---	46.5	53.5	86.9	11.1
99	---	37.5	62.5	87.8	11.2
100	---	28.5	71.5	88.8	11.2
101	---	19.0	81.0	89.8	11.2
102	---	10.0	90.0	90.8	11.2
103	---	1.5	98.5	91.7	11.3

TABLE C-III

SUPPLIERS' FUEL INSPECTIONS

1987/1988 FBRSU FUELS

	Low-Octane Base Blend RMFD 365-87/88	Intermediate-Octane Base Blend RMFD 366-87/88	High-Octane Base Blend RMFD 367-87/88
Laboratory Inspection			
Distillation, °F			
IBP	100	96	96
10% Evap.	134	128	127
30% Evap.	172	167	184
50% Evap.	204	216	237
70% Evap.	245	277	256
90% Evap.	357	367	304
End Point	417	413	392
RVP, psi	7.3	7.8	7.6
Lead, g/gal.	0.000	0.000	0.000
Oxidation Stab., min.	1440+	1440+	1440+
Hydrocarbon Type, Vol. %			
Aromatics	12.8	27.9	63.3
Olefins	34.7	20.4	1.5
Saturates	52.5	51.7	35.3
Research Octane Number	79.4	90.8	103.2
Motor Octane Number	72.4	80.6	89.5
Sensitivity	7.0	10.2	13.7

TABLE C-IV

OCTANE NUMBERS AND COMPOSITIONS FOR 1987/1988 FBRSU FUELS

Research Octane Number	Volume Percent RMFD 365-87/88	RMFD 366-87/88	RMFD 367-87/88	Motor Octane Number	Sensitivity
80	96.0	4.0	---	72.6	7.4
82	78.5	21.5	---	74.0	8.0
84	61.0	39.0	---	75.5	8.5
85	52.0	48.0	---	76.1	8.9
86	43.5	56.5	---	76.7	9.3
87	34.5	65.5	---	77.4	9.6
88	26.0	74.0	---	78.1	9.9
89	17.0	83.0	---	78.8	10.2
90	8.0	92.0	---	79.5	10.5
91	---	99.0	1.0	80.2	10.8
92	---	92.0	8.0	80.9	11.1
93	---	85.0	15.0	81.5	11.5
94	---	77.5	22.5	82.2	11.8
95	---	69.5	30.5	83.0	12.0
96	---	61.0	39.0	83.8	12.2
97	---	52.5	47.5	84.5	12.5
98	---	43.0	57.0	85.4	12.6
99	---	34.0	66.0	86.2	12.8
100	---	25.0	75.0	87.1	12.9
101	---	16.0	84.0	88.0	13.0
102	---	7.0	93.0	88.8	13.2
102.8	---	0.0	100.0	89.6	13.2

APPENDIX D

PROGRAM

COORDINATING RESEARCH COUNCIL
INCORPORATED
219 PERIMETER CENTER PARKWAY
ATLANTA, GEORGIA 30346
(404) 396-3400

PROGRAM

for the

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

CRC Project No. CM-123-87

October 1986

TABLE OF CONTENTS

I. INTRODUCTION

The 1987 program of the CRC Light-Duty Octane Number Requirement Survey Group will consist of a survey of the octane number requirements of 1987 model domestic and imported vehicles. For the purposes of this program, the designation "passenger vehicles" will include passenger cars, light-duty (<8500 lb/3856 kg GVW) pickup trucks, and vans. Approximately 400 vehicles will be tested. Most of these vehicles will be sampled in proportion to their relative production or import volume, to provide data from which to estimate the distribution of octane number requirements for the 1987 model vehicle population in the United States. In addition, select models of special interest will be tested in sufficient numbers to estimate their requirement distributions.

Knocking characteristics will be investigated with three series of reference fuels. Tank fuel knock will also be evaluated. Maximum octane number requirements, whether at maximum-throttle or part-throttle, will be established for each vehicle using high sensitivity unleaded full-boiling range reference (FBRSU) fuels, average sensitivity unleaded full-boiling range reference (FBRU) fuels, and primary reference (PR) fuels. If the maximum requirement is at maximum-throttle, then part-throttle requirements are investigated with only FBRU fuels of up to, and including, four octane numbers lower than the maximum requirement. Also, minimum requirements are determined for knock-sensor equipped vehicles.

II. GEOGRAPHICAL AREAS

As in previous years, the 1987 Survey will be conducted on a nationwide basis. The country has been divided into four geographical areas. Participants located in New York, New Jersey, Delaware, and Pennsylvania have been included in the Eastern Area; those located in Ohio, Michigan, and Kentucky comprise the East Central Area; those in Illinois, Texas, and Oklahoma comprise the West Central Area; and California participants make up the Western Area. A coordinator has been appointed for each area as follows:

Eastern Area.....R. A. Bouffard
East Central Area.....C. P. Sherwood
West Central Area.....J. B. Baker
Western Area.....T. Wusz

The area coordinators will contact their area participants periodically regarding the progress of the survey. To expedite this, it is suggested that participants send copies of all correspondence concerning the survey to the area coordinators. This program outlines the survey in broad terms. If more detailed information is desired, it is suggested that the participant contact his area coordinator.

III. VEHICLES

A total of approximately 400 vehicles will be tested in the 1987 Survey. Current experience indicates we can expect about 11 full participants and 5 partial participants. The 400 vehicle total will be divided into two groups: (1) the statistical group, sampled in proportion to US car model production or import volume, and (2) select models of special interest. Approximately 20 of each of these select models are assigned to be tested in order to provide an estimate of the octane requirement distribution of each model. Some of these 20 vehicles will be those already included in the statistical group, and the remainder will be additional vehicles added to the program.

The desired number of vehicles to be tested in each category is as follows:

Statistical Group	350
Additional Select Model Group	50
Total	400

A detailed breakdown of the specific models and the number of each model to be tested will be circulated to the participants in May 1987 after an estimate of vehicle model production has been obtained. Design specifications for select models to be tested in the 1987 Survey are shown in Table D-1. Selection of these vehicles has been based on new or modified design characteristics that might have a significant effect on octane number requirements and high sales volume which allows individual treatment without additional testing.

Wherever possible, specific vehicle assignments to individual participating laboratories will be made in a pattern which tends to minimize data bias. This will be accomplished by apportioning cars of a given model among the four geographical areas, and subsequently among the laboratories within each area, in order to minimize the effect of non-random factors on the results of the Survey.

IV. FUELS

A. Full-Boiling Range Reference Fuels

Two full-boiling range reference fuel series will be used to define the vehicle octane number requirements. The two series will be unleaded and of varying sensitivity. One series will be comparable to the average sensitivity of unleaded commercial fuels (FBRU); the other series (FBRSU) will be a minimum of two numbers higher in sensitivity than the FBRU fuels. The Research octane number (RON) range for both fuel series is 79 to 104.

The two series will be blended in increments of two RON up to 84, and one RON above 84 from three base fuels for each series. The base fuels are compounded from normal refinery gasoline components. Limiting specifications for each base fuel for both series are shown in Table D-II. These specifications apply to both the 1987 and 1988 Surveys.

Research and Motor ratings will be determined for incremental blends of each fuel series by participants to provide data for establishment of blending curves.

B. Primary Reference Fuels

Blends of ASTM-grade isooctane and normal heptane will be prepared in two octane number increments from 76 to 82, and one octane number increments from 82 to 100.

C. Tank Gasoline

Research and Motor octane ratings will be obtained only on gasoline samples from the tank of vehicles with owner questionnaire (Attachment 1). Owner's Questionnaire should be obtained if:

a) vehicle has a regular driver;

b) the ignition timing is within $\pm$ 2° of the manufacturer's specifications.

V. TEST TECHNIQUE

All tests are to be conducted using the technique entitled, "Technique for Determination of Octane Number Requirements of Light-Duty Vehicles" (CRC Designation E-15-87). A copy of this technique is included as Attachment 2 to this program. Octane number requirement investigations are to be conducted in all vehicles under level road conditions. Any vehicle obviously in poor mechanical condition or with malfunctioning emission control devices should not be considered for test work. The vehicles must have a minimum of 6000 deposit miles (9656 km), and preferably be privately owned and operated. Data with less than 6000 miles will not be analyzed. Vehicles previously used for fuel road octane rating must not be employed in this survey.

Data should be reported on each vehicle tested, even though knock was not encountered on any of the fuels.

The order in which the fuels are to be tested is as follows:

1) Tank fuel;
2) FBRSU;
3) FBRU;
4) PR.

VI. DATA FORMS

The test results on each vehicle will be reported on data forms DFMF-11-87 and DFMF-19-87. For knock sensor-equipped vehicles, data forms should be filled out completely for maximum requirements and include vehicle information with minimum requirements. Copies of these forms will be mailed to all participants from the CRC office with instructions for their use. Additional instructions are included in the E-15-87 technique.

VII. REPORTING RESULTS

The original data forms for each vehicle tested should be submitted to William F. Biller, 68 Yorktown Road, East Brunswick, New Jersey 08816, as soon as possible, but not later than October 31, 1987.

TABLE D-I

DESIGN SPECIFICATIONS FOR 1987 SELECT MODELS

Make & Model	Engine Displ. Liters	Configuration & No. of Cylinders	Fuel System	Comp. Ratio	BHP	Knock-Sensor	VIN Engine Code	Trans. Type
GM								
S10/S15 Pick Up	2.8	V-6	TBI			No	--	A
J Car (Ex Chev)	2.0	L4	TBI	9.0	90	No	K	A
Ford								
Escort/Lynx EXP	1.9	4	CFI	9.0	90	No	9	A3
Taurus/Sable	3.0	V-6	EFI	9.25	140	Yes	U	A4
Chrysler								
S Body (Mini Van)	3.0	V-6	EFI	9.0	140	No	--	A3
N Body (Dakota Pick Up)	3.9	V-6	2 bbl	9.2	125	No		A

TABLE D-II

*LIMITING SPECIFICATIONS FOR 1987 AND 1988 FULL-BOILING RANGE REFERENCE FUELS**

Inspection Tests	Unleaded Average Sensitivity Reference Fuels (FBRU)			Unleaded High Sensitivity Reference Fuels (FBRSU)		
	RMFD 362		RMFD 363	RMFD 364	RMFD 365	RMFD 366	RMFD 367
ASTM Distillation, °F(°C)							
IBP, Min.	90	(32.2)	90	90	90	90	90
10% Evap.	115-158	(46.1- 70.0)	115-158	115-158	115-158	115-158	115-158
30% Evap.	150-190	(65.6- 87.8)	150-190	150-190	150-190	150-190	150-190
50% Evap.	195-250	(90.6-121.1)	195-250	195-250	195-250	195-250	195-250
70% Evap.	230-300	(110.0-148.9)	230-300	230-300	230-300	230-300	230-300
90% Evap.	285-374	(140.6-190.0)	285-374	285-374	285-374	285-374	285-374
End Point, Max.	437	(225)	437	437	437	437	437
RVP, psi (KPa)	7-9	(48-62)	7-9	7-9	7-9	7-9	7-9
Lead, g/gal (g/l)	<0.03	(<0.008)	<0.03	<0.03	<0.03	<0.03	<0.03
Oxidation Stability, Minutes, Min.	1440		1440	1440	1440	1440	1440
Hydrocarbon Type, Vol. %							
Aromatics, Max.**	20		35	55	35	45	65
Olefins, Max.	20		15	10	35	25	15
Saturates	Remainder		Remainder	Remainder	Remainder	Remainder	Remainder
Octane Number							
Research	79 ± 1		91 ± 1	104 ± 1	79 ± 1	91 ± 1	104 ± 1
Sensitivity***	4.5 ± .5		8.5 ± .5	11.5 ± .5	6.5 ± .5	10.5 ± .5	13.5 ± .5
Minimum of two units sensitivity difference between corresponding fuels of each series.							
Color	Bronze		Green	Red	Yellow	Deep Purple	Light Blue

Note: All fuels to contain minimum 5 PTB of a 100% active antioxidant and 10 PTB of corrosion inhibitor. No manganese added.
Confirmation of product quality of fuel blends to be approved by a six-laboratory CRC Fuel Acceptance Panel prior to drumming.

* To be compounded from normal refinery components. Oxygenates are not to be used as fuel components.
** 1% maximum Benzene or legal.
*** Sensitivities are shown for the mean Research octane number.

CRC OCTANE NUMBER REQUIREMENT SURVEY

OWNER'S QUESTIONNAIRE

OWNER:

Your vehicle is being tested for fuel octane number requirements by a Coordinating Research Council activity. To help analyze the data, we would like the person who has recently been driving the vehicle to answer the following questions:

1. What grade of unleaded fuel is now in the tank?

☐ Regular ☐ Premium ☐ Mixture

2. Has any engine knock (ping) been encountered with the fuel that is now in the tank?

☐ Yes ☐ No

3. Did you consider the knock (ping) objectionable?

☐ Yes ☐ No

Vehicle Make _____ License No. _____

Vehicle Identification No. _____

Company Testing Vehicle _____

Attachment 2

TECHNIQUE FOR DETERMINATION OF OCTANE NUMBER REQUIREMENTS OF LIGHT-DUTY VEHICLES

(CRC Designation E-15-87)

August 1987

TECHNIQUE FOR DETERMINATION OF OCTANE NUMBER REQUIREMENTS OF LIGHT-DUTY VEHICLES

(CRC Designation E-15-87 - Including Annex A)

A. GENERAL

The technique provides for the determination of maximum octane number requirements (and minimum octane number requirements for vehicles equipped with knock sensors), whether at maximum-throttle or part-throttle, of a vehicle in terms of borderline spark knock on two series of full-boiling range reference fuels as well as on primary reference fuels. If the maximum requirement is at maximum-throttle, then part-throttle requirements are investigated with only FBRU fuels of up to, and including, four octane numbers lower than the maximum requirement.

Knock intensity on tank fuel will be measured.

B. DEFINITION OF TERMS

The following definitions of knock, approved by the CLR and CFR Committees on June 8, 1954, have been rephrased for clarification and adaptability to current technology by the Survey Steering Panel.

1. Spark Knock:

Spark knock is the noise associated with the autoignition* of a portion of the fuel-air mixture ahead of the advancing flame front. It is recurrent and repeatable in terms of audibility and fuel octane quality. This includes knock occurring when going from road load to other operating conditions (e.g., tip-in, etc.).

2. Knock Intensity

a. Borderline Knock

This means spark knock of lowest audible intensity of at least three (3) pings, and over a range of engine speed of at least 50 rpm, all being repeatable during subsequent accelerations.

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* Autoignition: The spontaneous ignition and the resulting very rapid reaction of a portion or all of the fuel-air mixture. The flame speed is many, many times greater than that which follows normal spark ignition. There is no time reference for autoignition.

b. No Knock

This means either no audible knock or knock less than borderline intensity.

c. Above Borderline Knock

This means spark knock of greater than borderline intensity.

3. Octane Number Requirements

a. Maximum Requirement

This is equivalent to the octane number of the highest reference fuel giving borderline knock as previously defined (the next higher fuel gives no knock). If the knock intensity with the highest fuel giving knock is above borderline, the maximum requirement shall be equivalent to the mid-point between the octane number of the fuel giving knock and that of the next higher fuel which gives no knock.

b. Minimum Requirement (for vehicles with knock sensors)

This is equivalent to the octane number of the lowest reference fuel giving borderline knock (the next lower fuel will give above borderline knock). If the knock intensity with the lowest fuel giving knock is above borderline and the next highest fuel is no knock, then the minimum requirement is the mid-point between the two.

4. Definition of Accelerations

Accelerations are made at maximum-throttle and part-throttle conditions which are defined below:

a. Maximum-Throttle

The throttle is depressed and held at either full-throttle or the widest throttle position that does not cause the transmission to downshift (detent) throughout the acceleration in each of the required test gears listed in D.3.d.(1)(a). The detent manifold vacuum/pressure obtainable on a given model is determined by the transmission characteristics. For manual transmissions, the throttle is depressed fully throughout the acceleration.

b. Part-Throttle

The throttle is depressed and regulated throughout the acceleration to maintain a desired, constant critical manifold vacuum/pressure as defined in D.3.d.(1)(d).

C. VEHICLE PREPARATION

The following vehicle preparation steps should be completed before any octane tests are run. Detailed procedures for each adjustment can be found in the manufacturers' shop manuals.

1. Record vehicle identification number and emission control type, Federal, Altitude, California, or Fifty-State. Fill in heading on data sheet DFMF-11-87. For knock sensor-equipped vehicles, two DFMF-11-87 data sheets should be filled out completely: one for maximum requirement, and one for minimum requirement. Ford emission calibration numbers are to be recorded.

2. Inspect all vacuum lines and air pump hoses for appropriate connections. Also, check to see if PCV valve, spark advance vacuum delay controls, EGR valve, knock sensors, and heated inlet air mechanism are functioning. Engine must be warmed up for these checks.

3. Record engine idle speed and observe anti-dieseling solenoid operation. Adjust to manufacturers' recommended specifications as specified on the under-hood decal.

4. Observe and record basic spark timing at recommended engine speed. Adjust to manufacturers' recommended setting as specified on the under-hood decal.

5. Crankcase oil, radiator coolant, automatic transmission fluid, and battery fluid levels shall be maintained as recommended by the manufacturer.

6. A calibrated tachometer graduated in 100 rpm (or smaller) increments and capable of indicating engine speed from 0-5000 rpm shall be installed on the vehicle.

7. One calibrated vacuum gage, graduated in one-half inch of mercury (or smaller) increments and capable of indicating vacuum from 0-24 inches of mercury (0-81 kPa) shall be connected to the intake manifold. For vehicles with turbochargers, a compound vacuum/pressure gage should be used; the pressure side of the gage should be capable of indicating pressures up to 15 psig (103 kPa).

8. An auxiliary fuel system shall be provided to supply test fuels to the engine. Caution shall be taken to avoid placing auxiliary fuel lines in locations which promote vapor lock. If vehicles with carbureted engines have tank return fuel lines, this return line should be blocked off. Disconnect fuel tank vent line at evaporation control system canister. Instructions for the auxiliary fuel system used with fuel injection systems are given in Annex A.

9. For vehicles with owner questionnaire completed, a sample of the tank gasoline shall be withdrawn for determination of Research and Motor method octane number ratings. If insufficient fuel is available, omit this step and obtain tank fuel observations as described in Item D.3.d.(2).

D. TEST PROCEDURE

1. Engine Warm-Up

a. To stabilize engine temperatures, a minimum of ten miles of warm-up is required. The test vehicle should be operated at 55 mph (88 kph) in top gear with a minimum of full-throttle operation.

b. During the warm-up period, the general mechanical condition of the vehicle should be checked to insure satisfactory and safe operation during test work.

2. Fuel Changeover

To eliminate contamination of the new fuel with residual amounts of the previous fuel, fuel-injected systems should be flushed once with new fuel and carburetted systems should be flushed twice. Fuel handling procedures for vehicles equipped with fuel injection systems are explained in Annex A.

After fuel changeover, make one maximum-throttle acceleration before beginning Vehicle Rating Procedure.

3. Details of Observations

a. Operating Conditions

All octane number requirements will be determined under level road acceleration conditions.

Tests will be conducted on moderately dry days, preferably at ambient temperatures between 60°F (15.5°C) and 90°F (32.2°C). Tests should not be conducted during periods of high humidity such as prevail when rain is threatening or during or immediately after a rain storm. Laboratories with control capabilities should target for 70°F (21°C) air temperature and 50 grains of water per pound (7.14 gm/kg) of dry air whenever possible.

Air-conditioned vehicles will be tested with air conditioner turned ON. (Normal setting, minimum temperature, low fan.) Air conditioner will be ON at all times.

b. Order of Fuel Testing

1) Tank
2) FBRSU
3) FBRU
4) Primary

c. Determination of Knock Intensity

Maximum octane requirements will be established by evaluating the occurrence of knock in terms of knock intensity: "N" for none, "B" for borderline, and "A" for above borderline. Establishment of representative knock intensity for a given fuel will be accomplished with a maximum of three (3) rated accelerations. Coastdown time between the end of one acceleration and the beginning of the next should be approximately twenty (20) seconds. As defined below, the first two duplicating accelerations are sufficient with "N" and "B" intensity.

Acceleration Number			Representative Rating
1	2	3	
N	N	-	N
N	B	N	N
N	B	B	B
B	N	B	B
B	B	-	B
B	A	-	A
A	-	-	A

All subsequent accelerations will normally be discontinued when "A" knock intensity is experienced, and testing continued with a higher octane number fuel in that series. An exception will be made if "A" knock is experienced on the highest octane fuel which knocks in the engine. In this case, it may be necessary to run additional accelerations to determine the speed of maximum knock intensity. If "A" knock is experienced at initiation of acceleration, as limited by transmission characteristics, this speed will be considered the speed of maximum knock. Otherwise, the midpoint between knock-in and knock-out will be considered the speed of maximum knock. When establishing knock-in and knock-out, back off on the throttle between points to eliminate "A" knock.

Minimum octane number requirements for vehicles equipped with knock sensors will be established in a similar manner except that when "A" knock intensity is encountered, subsequent accelerations will be made with a given fuel until duplicate "A" ratings are obtained over a measurable range of engine speeds as indicated below:

Acceleration Number			Representative Rating
1	2	3	
B	A	B	B
B	A	A	A
A	A	-	A
A	B	B	B

d. Determination of Octane Requirements

Tests should be run to 70 mph (113 kph). If required to terminate at lower speed, termination speed should be noted on data sheet.

(1) Vehicle Operating Procedure

(a) Establishment of Automatic Transmission Characteristics

Determine the minimum attainable road speed, and obtain the transmission downshift characteristics of engine rpm and manifold vacuum/pressure from minimum speed at 25, 35, 45, 55, and 65 mph (40, 56, 72, 88 and 104 kph) as applicable (as obtainable in each gear), by movement of the throttle through the detent, i.e., downshift, throttle position. These characteristics are to be determined for each of the gears specified in the table below. For transmissions with converter clutches, determine the minimum road speed for clutch application. At this initial speed and at 10 mph (16 kph), increments up to about 60 mph (97 kph) determine minimum vacuums (pressures) for application. Record all road speed/engine rpm/vacuum or pressure measurements from above on data sheet.

Do not use brakes, turn signals or hazard flashers during accelerations as these may affect electronic engine controls.

The selection of required test gears, and test gear/converter clutch combinations (if applicable) for various types of transmissions are shown in Table T-I. Transmissions not explicitly described should be tested in a manner as similar as possible to those listed. Automatic transmission vehicles should be tested with the gear selector in D or O; top gear should not be locked out. Transmissions equipped with electronic overdrive should be operated in overdrive. Transmissions equipped with power/normal selection should be operated in the normal position.

TABLE T-I

TRANSMISSION GEAR SELECTION

AUTOMATICS

Place the selector in "D" or "O" and check for critical condition.

Type	Gears to be Tested
GM 4-speed	4th gear, converter clutch engaged
	3rd gear, converter clutch engaged
	3rd gear, converter clutch disengaged
	2nd gear, converter clutch disengaged
GM 3-speed/ Chrysler 3-speed with converter clutch	3rd gear, converter clutch engaged
	3rd gear, converter clutch disengaged
	2nd gear, converter clutch disengaged
Ford Front-Wheel Drive:	
4-speed overdrive	4th gear, converter clutch engaged
	4th gear, converter clutch disengaged
	3rd gear, converter clutch engaged, if applicable
	3rd gear, converter clutch disengaged
	2nd gear
Ford Rear-Wheel Drive:	
4-speed overdrive	4th gear, converter clutch engaged, if applicable
	4th gear, converter clutch disengaged
	3rd gear, converter clutch engaged, if applicable
	3rd gear, converter clutch disengaged
	2nd gear
Other 3-speed	3rd gear
	2nd gear

MANUALS

5-speed	4th and 3rd gears
4-speed	4th and 3rd gears
3-speed	3rd and 2nd gears

(b) Maximum-Throttle Accelerations - Automatic Transmissions

For maximum-throttle accelerations in each of the gears and gear/converter clutch combinations specified above, accelerate at the detent/application condition according to the speed versus vacuum/pressure profiles determined in (a) from the minimum obtainable speed up to 70 mph (113 kph). If the transmission downshifts, abort and start the acceleration again. Start with the highest gear or gear/clutch combination and proceed in descending order.

(c) Maximum-Throttle Accelerations - Manual Transmissions

Select the highest gear as specified in the table above. Start at the lowest speed from which the vehicle will accelerate smoothly or 25 mph (40 kph), whichever is higher, and depress the throttle full throughout the acceleration up to 70 mph (113 kph).

Select the next lower gear specified in the table above and accelerate at full throttle from the minimum speed from which the vehicle will accelerate smoothly up to 70 mph (113 kph).

(d) Part-Throttle Accelerations for Both Automatic and Manual Transmissions

Select the highest gear as specified in Table T-I for manual transmissions. Select the two highest gears as specified in Table T-I for automatic transmissions. For example, on a four-speed automatic transmission, check both fourth locked and unlocked and third locked and unlocked; on a three-speed automatic transmission, check third locked and unlocked and second. For automatic transmissions with converter clutches use the highest gear up to the minimum vehicle speed at which the converter clutch will engage, and the highest gear/converter clutch combination above this minimum speed, to obtain the critical part-throttle vacuum or pressure. To obtain the critical part-throttle vacuum/pressure, first operate at constant speed road load, at 25, 35, 45, 55, and 65 mph (40, 56, 72, 88, and 104 kph) incremental speeds if obtainable in the specified gear. At each speed, move the throttle in approximately 3 seconds from the road-load vacuum to the positions described below for naturally aspirated and turbocharged engines:

1. for naturally aspirated vehicles, one inch Hg (3.4 kPa) above:

   a. full-throttle vacuum for manual transmissions;

   b. detent vacuum for automatic transmissions without converter clutches;

   c. the minimum vacuum at which the converter clutch disengages for so-equipped automatic transmissions.

2. for turbocharged vehicles, one psi (3.4 kPa) below:

   a. full-throttle maximum boost for manual transmissions;

   b. maximum boost at detent for automatic transmissions without converter clutches;

   c. maximum boost or 0.5 psig (1.7 kPa) above the minimum vacuum at which the converter clutch disengages for so-equipped automatic transmissions.

Use of vehicle brakes should be avoided.

If knocking occurs within any of the vacuum/pressure ranges, establish the manifold vacuum/pressure which gives maximum knock intensity on each fuel series. This is the critical vacuum/pressure to be used for all subsequent constant-vacuum/pressure part-throttle accelerations from the minimum obtainable speed in the test gear to 70 mph (113 kph), or until the vehicle ceases to accelerate. This critical vacuum/pressure should be determined for each reference fuel series.

(2) Tank Fuel Observations

Investigate for maximum-throttle and part-throttle knock as detailed in Item 3d(1). Define maximum knock intensity as per Item 3c. Record maximum knock intensity, speed of maximum knock intensity, and manifold vacuum/pressure at each operating condition.

(3) Vehicle Rating Procedure

All initial accelerations should be started from minimum obtainable gear/converter clutch combination at constant level road-load conditions. Knock rating should be performed while in a normal upright seated position with floor mats in place.

Step 1 - After Tank Fuel Observations, use a fuel estimated to give borderline knock in a given fuel series and investigate for incidence of knock under conditions as described in D.3.d.(1)(b) above, and D.3.d.(1)(c) above, whichever is applicable.

Step 2 - If no knock occurs, go to a lower octane number blend in that series and repeat Step 1.

Step 3 - If knock occurs at one or more of the operating conditions in Step 1, continue investigation at the critical condition(s) with higher octane blends until highest octane fuel giving knock is determined within one octane number or one blend (the next higher fuel giving no knock). Record maximum knock intensity on all fuels. Record speed of maximum knock intensity and manifold vacuum/pressure on highest octane fuel that knocks.

Step 4 - Using the lowest octane blend that did not knock in Step 3, investigate for incidence of part-throttle knock as described in D.3.d.(1)(d). If knock occurs, continue investigation at critical vacuum/pressure until requirement is defined. Record maximum knock intensity and critical manifold vacuum/pressure on all fuels, and speed of maximum knock intensity on highest octane fuel that knocks.

Step 5 - With FBRU fuel only, if no knock occurs in Step 4, go to a lower octane number blend and repeat Step 4. Discontinue part-throttle investigation if knock is not observed with a fuel four octane numbers lower than determined in Step 3.

Step 6 - For knock-sensor equipped vehicles after determination of maximum requirement, continue with lower octane blends until the lowest octane fuel giving borderline knock is determined (the next lowest fuel giving above borderline knock).

The rating procedure is given in arrow diagram form on page D-24 for maximum requirement, and on page D-25 for minimum requirement, for knock sensor-equipped cars.

E. INTERPRETATION OF DATA

The data will be recorded on data sheets DFMF-11-87 and DFMF-19-87. Data Form DFMF-11-87 has provisions for recording both the maximum and minimum requirements of knock-sensor equipped vehicles on the same sheet. Additional data sheets for recording run data may be appended to DFMF-11-87 as needed. Octane requirements for all reference fuels shall be determined as follows:

1. If the knock intensity of the highest reference fuel giving knock is borderline, the requirement shall be reported as the octane number of that fuel.

2. If the knock intensity of the highest fuel giving knock is above borderline, the requirement shall be reported as the mid-point between the octane number of the fuel giving knock and that of the next higher fuel.

3. If the octane requirement in high gear is equal to the requirement in a lower gear, report the highest gear data.

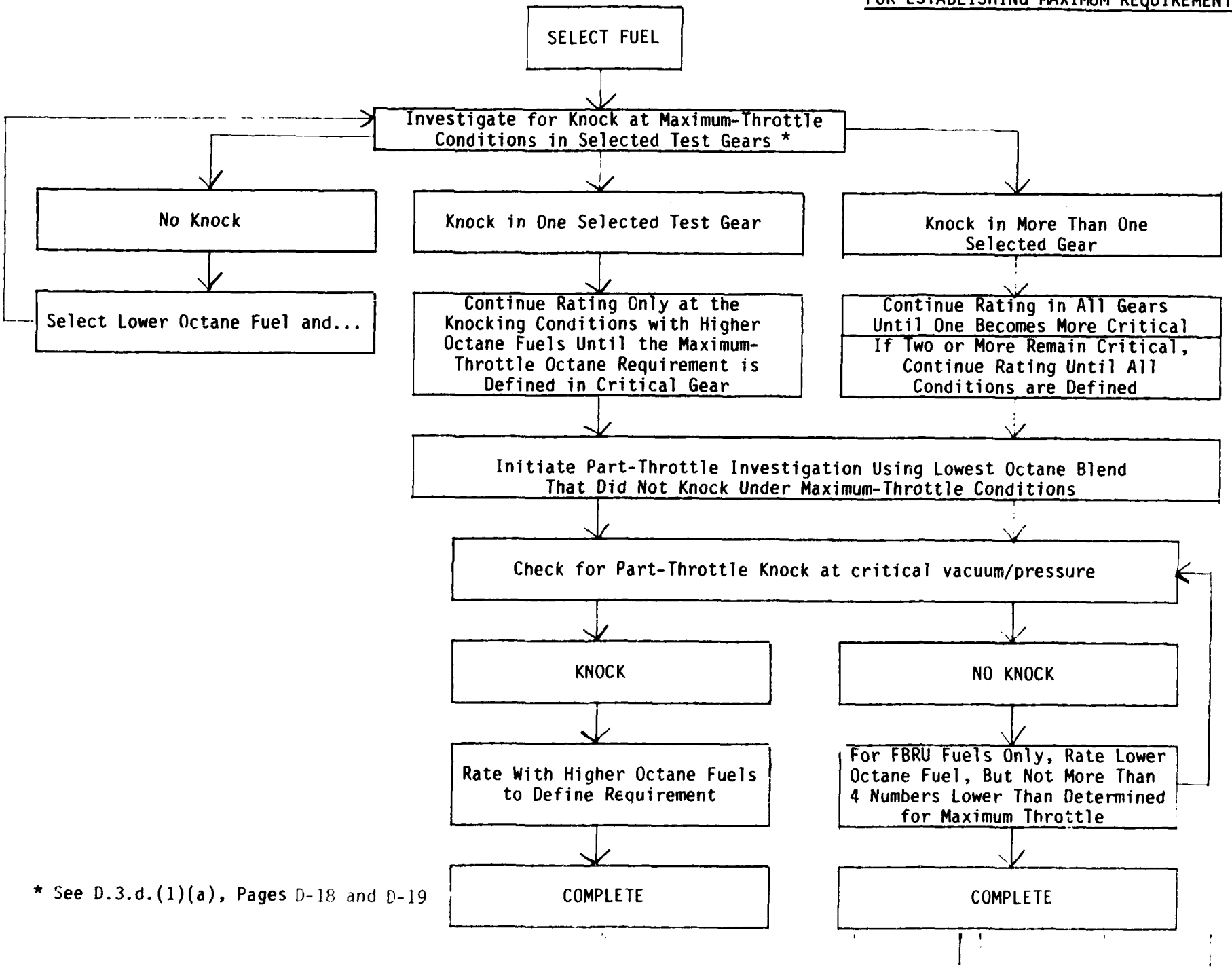
4. For part-throttle requirements, report the data from the critical manifold vacuum/pressure observations.

5. For knock-sensor equipped vehicles, report the highest and lowest fuel giving borderline knock. If the knock intensity with the lowest fuel giving knock is above borderline and the next highest fuel is no knock, then the minimum requirement is the mid-point between the two.

Record data on all fuels tested, even though knock was not encountered. The octane number requirement summary block on the first sheet of DFMF-11-87 provides space for both the maximum and the minimum requirements of knock-sensor equipped vehicles. When transferring data to the summary block, record maximum-throttle and part-throttle octane number requirements in the appropriate blocks. The higher of the two will be selected by the computer as the maximum octane number requirement. If both maximum-throttle and part-throttle requirements are equal, then the computer will select the part-throttle requirement as the maximum octane number requirement. Use proper letter designation (see footnotes on data sheet) to designate: (1) requirements outside of the reference fuel limits; (2) FBRU part-throttle requirement more than four numbers below maximum; and (3) all other cases for which the octane number requirement has not been determined. Note that in the case of a converter-clutch equipped vehicle, test gear numbers should indicate whether the converter clutch was locked or unlocked. Note also that in the case of turbo-equipped vehicles, a manifold pressure above atmospheric is indicated as a <u>negative</u> number in units of psig.

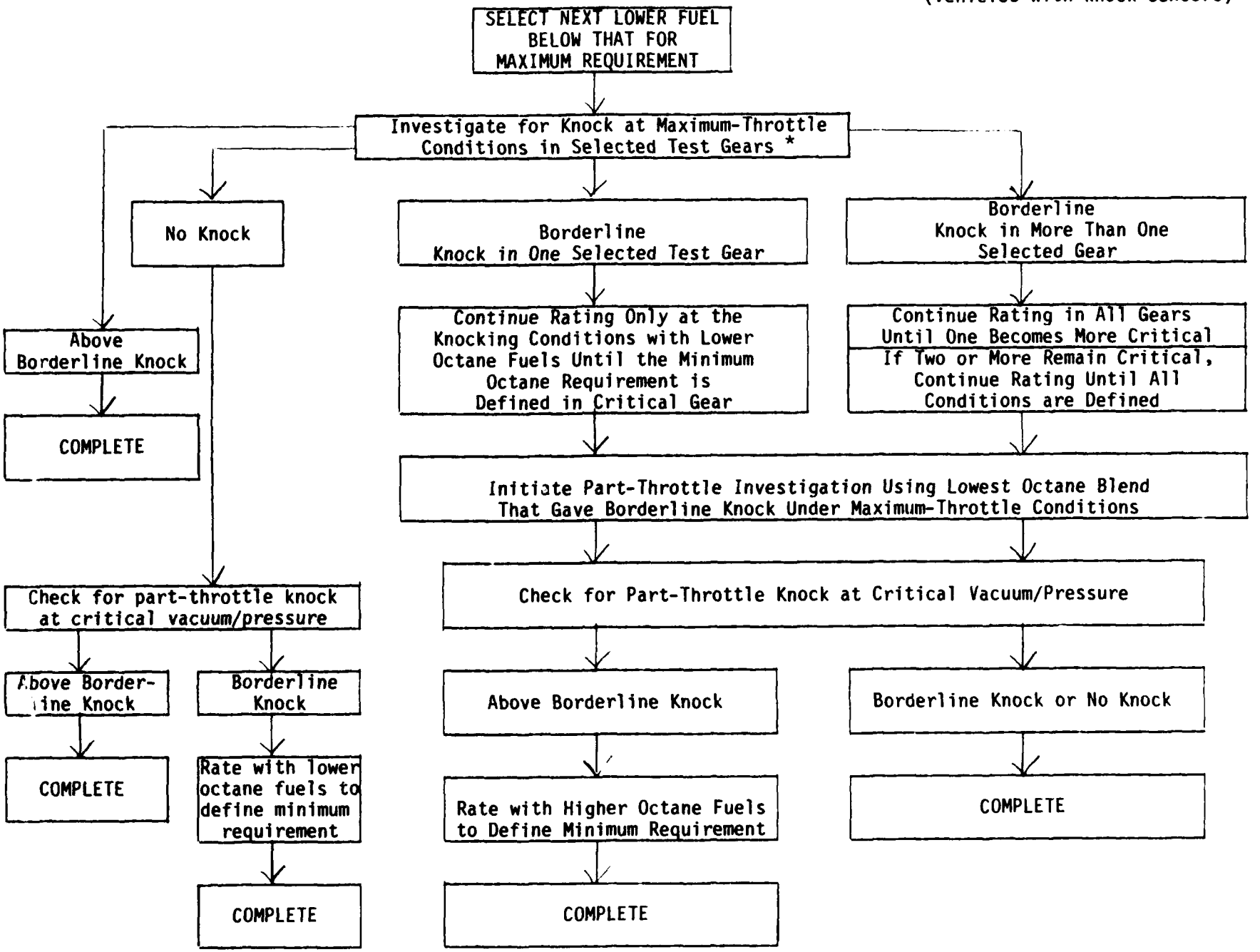
It is important that the vehicle identification number (VIN) of each vehicle tested be recorded on all data sheets to provide a means of cross-indexing.

FOR ESTABLISHING MAXIMUM REQUIREMENTS



* See D.3.d.(1)(a), Pages D-18 and D-19

FOR ESTABLISHING MINIMUM REQUIREMENTS
(Vehicles with knock sensors)



* See D.3.d.(1)(a), Pages D-19 and D-19

ANNEX A

to the

CRC E-15-87 TECHNIQUE

PROCEDURE FOR SETTING UP VEHICLES WITH FUEL INJECTION

ANNEX A

PROCEDURE FOR SETTING UP VEHICLES AND HANDLING REFERENCE FUELS: VEHICLES EQUIPPED WITH FUEL INJECTION

1. To run octane requirements on fuel-injected vehicles, it is necessary to install an external fuel supply line with auxiliary electric fuel pump from the reference fuel can to the vehicle fuel system and an external return line back to the reference fuel can.

2. There are two types of fuel injection systems: throttle-body injection, and multi-port injection. As a general description, the systems will contain the following parts:

   Fuel Tank
   High- or Low-Pressure In-Tank Fuel Pump
   Fuel Supply Line(s)
   In-Line Filter(s)
   High-Pressure Chassis-Mounted Pump (not required for all vehicles)
   Fuel Rail (to supply multiple injectors on port fuel injection)
   Fuel-Pressure Regulator (integral on throttle-body, on fuel rail with multi-port injection; controls pressure at the injectors)

   Depending upon the vehicle's specific fuel system and/or tester's preference, installation of the required auxiliary equipment can be accomplished in a variety of ways.

3. The auxilliary fuel supply line may be installed anywhere between the fuel tank and the inlet at the throttle-body or fuel rail. the auxiliary fuel return line may be installed anywhere between the fuel-pressure regulator outlet and the tank.

4. After connections have been broken, the fuel lines on the fuel tank side should be capped and the vehicle's pump(s) disconnected or disarmed. Alternately, an additional fuel line can be looped between the supply and return lines and the vehicle pump(s) allowed to circulate fuel directly back to the fuel tank.

   The auxiliary fuel supply system must be capable of supplying fuel at slightly higher than the nominal regulated pressure (to overcome losses) to insure accurate results. This may be accomplished by using a high-pressure pump capable of being adjusted for the particular vehicle being tested, or by using a low-pressure pump to supply fuel to the chassis-mounted high-pressure pump if the testing lab chooses to keep it in the system. A fuel filter may be required between the auxiliary pump and the reference fuel can to protect the pump. The fuel return line should be connected to the reference fuel can through a tee at the auxiliary pump inlet. The reference fuel can should be vented to outside the vehicle.

   It is possible to use three-way valves in the fuel line between the fuel pump and the fuel tank and between the return line and the fuel tank. When used, the operator must change the return line valve to

the auxiliary fuel system while the engine is shut down, to avoid building up excessive pressure in the return line which could damge both the fuel-pressure regulator and injection pump.

5. When changing from one reference fuel can to another, the following steps should be followed:

   a. Disconnect fuel inlet line from reference fuel can and run engine a short time; do not run out of fuel since this will introduce air into the fuel injection system and excessive cranking will be required to restart the engine.

   b. With the engine shut off, disconnect the fuel return line from the reference fuel can and connect it to a slop can. Connect the fuel supply line to the new reference fuel can and run the engine long enough to purge the old reference fuel from the system. The time required will be dependent upon length of added fuel lines, but it will be approximately 30-60 seconds; approximately 1-2 quarts of fuel will be discarded to slop.(1)

   c. With the engine off, connect the fuel return line to the reference fuel can. The vehicle is then ready to be tested.

   d. When changing to the next reference fuel, it is necessary to repeat Steps a, b, and c.

CAUTIONS

Fuel supply lines remain pressurized long after the engine is shut off; be sure to relieve the pressure before disconnecting fuel lines.

Use fuel lines designed for high pressure. They should be rated for at least 250 psi working pressure and for 1000 psi burst pressure.

The engine and auxiliary fuel pumps should be shut off while changing from reference to tank fuels.

Purging procedures should be followed strictly to preclude reference fuel contamination or discarding more fuel than is required.

Vehicle pump(s) may be disarmed by use of the inertia switch. The voltage supplied to the inertia switch may then be used to power the auxiliary pump. When making these electrical connections, do not "splice" into the wire, instead connect the wire lead to the connector.

Use of the "rolled edge" style hose clamps, such as those made by Chrysler, is recommended to prevent damage to fuel lines.

Note: Diagnostic scanners should not be used while knock testing.

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(1) It is critical to circulate an adequate amount of fuel to the slop can to prevent reference fuel contamination.

APPENDIX E

1987 OCTANE NUMBER REQUIREMENT SURVEY DATA

GLOSSARY

(For Appendix E Only)

Emission Certification (EMCT):	A	Altitude
	C	California
	F	Federal
	B	Both California and Altitude
	E	Everything
Knock Sensor (KNK SEN):	Y	Yes
	N	No
Air Conditioner:	Y	Yes
	N	No
Spark Advance:	+	Before Top Center
	-	After Top Center
Test Fuel:	1	Tank Fuel
	2	FBRSU
	3	FBRU
	4	PR
Octane Number Requirements: (expressed as Research ON)	L	Less than lowest available ON for FBRU and FBRSU fuels and less than 76 for PR fuels
	H	Higher than highest available ON for FBRU and FBRSU fuels and higher than 100 ON for PR fuels
	F	Part-throttle requirement greater than four numbers below maximum-throttle requirement
Throttle (THR):	M	Maximum
	P	Part
Gear:	1-5	Manual and Automatic
Torque Converter (CONV):	U	Not tested in lockup
	L	Tested in lockup
Manifold Vacuum (MV):	Inches Hg, positive (+) for vacuum, negative (-) for pressure	
Owner-Reported Knock (OWKNK):	Y	Yes, Not Objectionable
	O	Objectionable
	N	No
Rater-Reported Noise Intensity (NINT):	N	None
	B	Borderline
	A	Above Borderline

'88' CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EM CT	MANA SEN	SPARK ADVANCE A/T C.P.	SPARK ADVANCE A/T R	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMMENTS	OCT NO RES	OCT NO MOT	RATER TRANS	RATER GEAR	RATER RPM	RATER MV
41-23	ACE P16A4	C	N	9.3	Y	+12	+12	15415	75	30.45	46	3	88.0	4U	2800	0.5					N			B	M	4U	3000	0.5
												2	89.0	4U	2900	0.5											
												4	87.0	4U	2900	0.5											
05-20	ACE P16M5	F	N	9.3	Y	+12	+12	14695	70	29.65	50	3	90.0	4	2300	0.2	F				N	94.4	84.0	N			
												2	92.0	4	2250	0.2											
												4	89.0	4	2300	0.2											
06-17	BGA P18M5	F	N	9.0	Y	- 6	- 6	10410	42	29.79	19	3	86.0	4	2800	0.4	85.0	4	2900	1.5	N	95.1	83.5	N			
												2	89.0	4	2850	0.4											
												4	84.0	4	2900	0.4											
47-14	BGC P18M5	C	Y	H	10.0	Y	+ 8	+ 6	12900	70	29.67	50	3	96.0	4	4500	0.5										
				H								2	98.0	4	4500	0.5											
				H								4	92.0	4	2000	0.5											
				L								3	94.0	4	4500	0.5											
				L								2	96.0	4	4400	0.5											
				L								4	90.0	4	2000	0.5											
06-09	BJA P18M5	F	N	9.0	Y	- 6	- 6	24667	68	30.12	60	3	89.0	4	2400	0.4					N	97.2	86.6	N			
												2	90.0	4	3600	0.6											
												4	87.0	4	2400	0.4											
45-15	BJB P18M5	F	Y	H	10.0	Y	+ 6	+ 6	17030	73	29.40	61	3	85.0	4	1425	1.2	85.0	4	1424	2.2	N	94.1	85.4	N			
				H								2	83.0	4	1450	1.3	83.0	4	1450	2.3							
				H								4	84.0	4	1425	1.2											
				L								3	84.0	4	1450	1.2											
				L								2	82.0	4	1450	1.3	82.0	4	1450	2.3							
				L								4	82.0	4	1650	1.2											
07-16	DHD T22A3	F	N	9.5	Y	+12	+12	20721	71	30.38	40	3	88.0	2	2900	0.2	85.0	3	2600	2.0	N	94.8	83.2	N			
												2	89.0	3	2800	0.3											
												4	88.0	2	3000	0.2											
25-09	DMP 252A3	F	Y	H	9.1	Y	+ 5	+ 5	19603	70	29.87	50	3	91.0	3U	1300	3.0	92.0	2U	1400	2.0				N			
				H								2	90.0	3U	1400	3.0	93.0	2U	1350	2.0							
				H								4	88.0	3U	1400	3.0	90.0	2U	1300	2.0							
				L								3	90.0	3U	1300	3.0	92.0	2U	1400	2.0							
				L								2	90.0	3U	1400	3.0	92.0	2U	1400	2.0							
				L								4	87.0	3U	1400	3.0	90.0	2U	1300	2.0							
06-13	EAP 216A3	F	N	9.4	Y	- 7	- 7	11443	47	30.16	20	3	90.0	3L	3000	1.8	91.0	3L	3000	6.0	N	93.0	82.0	A	P	3L	3000	6.0
												2	92.0	2U	3200	1.4	96.0	3L	3000	6.0							
												4	87.0	3L	3200	1.8											

'89? CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMI CAT	KNK SEN	SPARK ADVANCE INIT C.P.	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	MAXIMUM ENG SPD	MAXIMUM OCT NO	MAXIMUM AIR/FUEL RATIO	MAXIMUM PPM	MAXIMUM MV	PART THROTTLE ENG SPD	PART THROTTLE OCT NO	PART THROTTLE AIR/FUEL RATIO	PART THROTTLE PPM	PART THROTTLE MV	COMPARISON KNOCK	TANK FUEL INFORMATION OCT NO RES	OCT NO MOT	RATED KNOCK INT	RATED TIP IN	RATED ENG SPD	RATED AIR/FUEL RATIO	RATED PPM	RATED MV
55-02	EAP 216A3	C	N	9.4	Y	+10	+ 7	20488	66	29.14	72	3	87.0	2U	2800	1.5	P												
												2	87.3	2U	2900	1.5													
												4	86.5	2U	2800	1.5													
35-01	EAP 216M5	F	N	9.4	+	+ 7	+ 7	6988	72	30.20	26	3	85.0	4	2250	2.0	86.0	4	1600	5.0	N	95.3	86.0	N					
												2	85.0	4	2400	2.0	86.0	4	1850	5.0									
												4	85.0	4	1800	2.0													
41-11	EAP 216M5	C	N	9.4	Y	+ 7	+ 7	27076	71	30.25	28	3	87.0	4	1600	2.0								N	M				
												2	87.0	4	2400	2.0													
												4	85.0	4	1500	2.0													
46-01	EAP 216M5	F	N	9.4	Y	+ 7	+ 7	11833	73	29.39	60	3	91.0	4	1450	2.0	89.0	4	1575	3.0	N	90.5	83.1	B	P	4	1450		3.0
												2	91.0	4	1400	2.0	90.0	4	1375	3.0									
												4	91.0	4	1550	2.0													
47-10	EAP 216M5	C	N	9.4	Y	+ 5	+ 7	30728	70	30.14	50	3	85.0	4	3600	1.0	84.5	4	3600	1.0									
												2	86.0	4	3600	1.0													
												4	83.0	4	3600	1.0													
47-13	EAP 216M5	C	N	9.4	Y	+ 7	+ 7	15550	70	29.91	50	3	85.3	4	3600	1.0	89.0	4	1900	3.0									
												2	87.0	4	3700	1.0													
												4	84.0	4	3600	1.0													
28-17	EAP T16A3	F	N	9.4	Y	+ 7	+ 7	15226	70	29.24	50	3	87.0	3U	2600	0.7	84.0	3U	2550	3.0				B	M	3U	2450		0.7
												2	87.0	3U	2450	.7													
												4	86.0	3U	2350	0.7													
40-09	EBH P20A4	F	N	8.5	Y	+15	+15	8805	59	29.77	44	3	92.0	3U	2900	0.5	89.0	4L	1900	1.0				N					
												2	93.5	3U	3200	0.5													
												4	90.0	3U	2500	1.0													
52-01	EBH P20A4	F	N	8.5	Y	+15	+15	27811	71	29.95	49	3	90.0	4L			86.0	3U	2600	6.5	O	94.4	83.7	N					
												2	92.0	3L															
												4	88.0	3L	3100	0.4													
65-15	EBH P20M5	F	N	8.5	N	+15	+15	29518	45	29.75	27	3					95.0	4	1750	3.0									
												2					95.5	4	1650	3.5									
												4	94.0	4	1650	0.0													
52-08	ECE P16M5	F	Y	H	10.0	Y	+15	+15	14611	68	30.24	43	3	86.0	4	2800	0.1	86.0	4	2600	2.0	N	97.1	85.8	N					
				H								2	87.0	4	2600	0.1													
				H								4	88.0	4	2700	0.1													
				L								3	85.0	4	2800	0.1	85.0	4	2500	2.0									
				L								2	86.0	4	2700	0.1													
				L								4	86.0	4	2600	0.1													

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMI SENT	KNK SEN	C.R.	EAI RPO	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OMNI	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER THR	RATER GEA	RATER RPM	RATER MV
65-11	ECP T16A3	F	N	9.4	Y	+7	+7	9750	48	29.86	32	3	95.0	3U	2700	0.0	95.5	3L	3100	2.0								
												2	96.0	3L	3100	0.0	95.5	3L	3100	2.0								
												4	93.0	3U	2600	0.0												
41-20	EDP P20A4	F	N	8.5	Y	+15	+15	6391	72	30.16	49	3	88.0	3U	1800	1.0	87.0	4L	1800	3.0	N			N				
												2	90.0	3U	2300	1.0												
												4	87.0	3U	2200	1.0												
07-10	EEH P30A4	F	N	9.0	Y	+20	+20	19893	69	30.43	46	3	83.0	4L	1700	1.3	81.0	4L	2000	4.5	N	92.0	82.1	N				
												2	85.0	4L	1900	1.3												
												4	83.0	4L	1800	1.3												
29-05	EEH P30A4	F	N	9.0	Y	+23	+23	11500	70	30.09	62	3	87.5	4L	1900	1.2	87.0	3U	2300	3.0	N	95.3	86.9	N				
												2					88.5	3U	2300	3.0								
												4	86.5	4L	1800	1.2												
40-08	EEH P30M5	F	N	9.0	Y	+20	+20	7786	48	29.95	36	3	93.5	3	1400	0.0	F							N				
												2	92.5	3	1400	0.0												
												4	93.5	4	1500	0.0												
08-33	GC8 T41A4	F	N	9.0	Y			13885	80	29.40	37	3	87.0	4L	1450	2.0	86.0	4L	2025	6.0				N				
												2	88.0	3U	2300	1.5	88.0	4L	2025	6.0								
												4	84.0	3L	1950	1.5												
07-03	GC8 T41A4	F	N	9.0	Y	+10	+10	12472	73	30.16	52	3	88.0	4L	1800	1.0	85.0	4L	1750	3.0	N			N				
												2	88.0	3L	2150	0.5												
												4	86.0	3L	2100	0.5												
65-08	GC8 T41A4	F	N	9.0	Y	+10	+10	6295	66	29.14	49	3	86.5	4L	1300	0.0	85.5	4L	1250	3.0								
												2					88.5	4L	1250	3.0								
												4	86.0	4L	1400	0.0												
41-05	GC8 T41A4	F	N	9.0	Y	+10	+10	14799	71	30.08	67	3	86.0	3L	2200	1.5								N				
												2	99.0	3L	1900	1.5												
												4	85.0	3L	2000	1.5												
75-08	GLW P28A3	F	Y	H	8.9	Y		14851	62	29.24	70	3	90.5	2U	2500	2.0	90.5	2U	2500	5.0				A	M	2U	2600	2.0
				H								2	91.5	2U	2500	2.0												
				H								4	88.5	2U	2900	2.0												
				L								3	90.5	2U	2500	2.0	90.5	2U	2500	5.0								
				L								2	91.5	2U	2500	2.0												
				L								4	88.5	2U	2900	2.0												
29-11	HAR T25A3	F	N		8.3	Y		16151	70	29.80	65	3					99.0	3U	2600	4.0	Y	91.6	82.3	A	M	3L	1600	1.1
												2					102.0	3U	2450	4.0								
												4	90.5	3L	2000	1.1												

'88 CRC OCTANE NUMBER REQUIREMENT SURVE

OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	SPARK ADVANCE AIP	AS PCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	GEAR	RPM	MV	PART THROTTLE OCT NO	GEAR	RPM	MV	OWK KNK	TANK FUEL INFORMATION RATED OCT RES	RATED OCT MOT	GRADE	GEAR	RPM	MV
29-13	HAR T25A3	F	N	8.3	Y			12184	70	29.80	65	3					95.0	3U	2400	4.0	Y	91.0	82.8	A	M 3L	1900	1.2
												2	96.5	3L	1500	1.2											
												4	87.5	3U	2700	0.6											
46-12	HAR T25A3	F	N	8.3	Y			19152	78	29.75	67	3	91.0	2U	2675	1.0	86.0	3L	2150	3.0		90.8	83.1	B	M 3L	1875	1.0
												2	92.0	3U	2950	1.0											
												4	86.0	2U	2950	1.0											
08-17	HAW P28A3	F	Y	H	8.9	Y		12221	79	29.35	15	3	95.0	3L	1700	1.5	94.0	3L	2100	5.0				B	M 3U	2500	3.0
				H								2	96.0	3L	1600	1.5	95.0	3L	2150	5.0							
				H								4	92.0	3L	1900	1.5	90.0	3L	2150	5.0							
				L								3	93.0	3L	1700	1.5											
				L								2	94.0	3L	1600	1.5											
				L								4	90.0	3L	1900	1.5											
29-10	HAW P28A3	F	Y	H	8.9	Y		11721	70	30.20	57	3					97.5	2U	3300	2.0		91.9	82.8	A	M 3L	2000	1.1
				H								2					102.0	2U	2700	2.0							
				H								4	93.0	3L	1900	1.1											
				L								3					97.5	2U	3300	2.0							
				L								2					102.0	2U	2700	2.0							
				L								4	93.0	3L	1900	1.1											
29-23	HAW P28A3	F	Y	H	8.9	Y		14887	70	30.00	57	3					98.0	2U	3100	2.0	Y	91.4	82.2	A	M 3L	1900	1.0
				H								2					101.5	2U	3800	2.0							
				H								4	90.0	2U	2850	0.9											
				L								3					98.0	2U	3100	2.0							
				L								2					101.5	2U	3800	2.0							
				L								4	90.0	2U	2850	0.9											
29-09	HAW P28A4	F	Y	H	8.9	Y		15368	70	30.20	57	3	93.0	3U	2800	1.1	92.0	3L	2500	3.0	Y	91.7	82.2	A	M 3U	2200	1.1
				H								2	99.5	3U	3000	1.1											
				H								4	89.0	2U	2900	0.9											
				L								3	93.0	3U	2900	1.1											
				L								2	99.5	3U	3000	1.1											
				L								4	89.0	2U	2900	0.9											
75-01	HBY 450A4	F	Y	H	8.0	Y	+20	+20	6227	61	29.39	60	3	86.5	3L	2300	2.0	F						N			
				H								2	85.5	3L	1800	2.0	85.5	4L	1900	6.0							
				H								4	84.5	3U	2100	2.0											
				L								3	96.5	3L	2300	2.0	F										
				L								2	85.5	3L	1800	2.0	85.5	4L	1800	6.0							
				L								4	84.5	3L	2100	2.0											

'98? CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	ENG CONFIG	KNK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AS ROD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION: OCTANE NUMBER KNK	OCT NO RES	OCT NO MOT	NVH TYP	GEAR	RPM	MV
29-08	HFF P50A4	F	H	9.3	Y	+ 6	+ 6	11832	70	30.09	68	3	H			H				Y	95.8	87.0	A	M	4L	1500	0.6
			H									2	H													
			H									4	H													
			-									3	H			H										
			-									2	H													
			L									4	H													
41-13	HFF P50A4	C	H	9.3	Y	+ 6	+ 6	26167	73	30.03	55	3	89.0	2U	3300	1.5							N			
			H									2	90.0	2U	3500	1.5										
			H									4	89.0	2U	3300	1.5										
			L									3	89.0	2U	4000	1.5										
			L									2	89.0	2U	3600	1.5										
			-									4	88.0	2U	3600	1.5										
65-10	HFS P28A4	F	H	8.9	Y	+10	+10	9719	48	29.67	40	3	89.0	4L	1800	1.0	86.5	4L	1800	2.5						
			H									2	89.0	4L	1700	1.0										
			H									4	88.0	4L	1900	1.0										
			L									3	88.5	4L	1600	1.0										
			L									2	90.5	4L	1750	1.0										
			-									4	87.5	4L	1550	1.0										
06-12	HH3 P38A4	F	H	8.5	Y			12064	49	29.50	32	3	91.0	3U	1700	1.0	91.0	3U	2700	3.0	N	94.9	83.7	N			
			H									2	92.0	3U	1700	1.0										
			H									4	96.0	3U	2700	1.3										
			L									3	89.0	3U	2800	1.3										
			L									2	90.0	3U	2950	1.3										
			L									4	96.0	3U	2700	1.3										
23-25	HH3 P38A4	F	H	9.5	Y			22842	70	30.10	52	3	92.0	3U	2000	0.9	88.0	3L	1700	3.0	Y			A	M	3U	2000	0.9
			H									2	96.0	4L	1200	0.7										
			H									4	91.0	4L	1300	0.7										
			L									3	89.0	3U	1800	0.9										
			L									2	95.0	2U	2200	0.6										
			L									4	90.0	4L	1200	0.7										
23-08	HH3 P38A4	F	H	9.5	Y			14760	70	30.20	55	3	95.0	3U	2300	0.6	93.5	4U	2000	2.0	Y	91.8	82.4	A	M	4U	1700	0.8
			H									2	99.0	4L	1350	0.5										
			H									4	92.0	3U	2200	0.6										
			L									3	95.0	3U	2300	0.6										
			L									2	99.0	4L	1350	0.5										
			L									4	91.0	3U	2300	0.5										

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EM CT	KNK SEN	C.R.	SPARK ADVANCE A I P	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL CODE	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM M.	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE M.	TANK FUEL INFORMATION CONN	WATER OCT RES	WATER OCT MOT	WATER KNK INT	WATER KNK TYP	WATER GEAR	WATER RPM	WATER M.
29-18	HH3 P38A4	F	Y	H	8.5	Y		20279	70	30.40	52	3	93.0	4L	1200	0.4	92.0	3L	2200	3.0					N			
				H								2	93.0	3U	1900	0.7												
				H								4	90.0	2U	2000	0.6												
				L								3	92.0	4L	1250	0.4												
				L								2	93.0	3U	1900	0.7												
				L								4	86.0	2U	2000	0.6												
47-20	HH3 P38A4	F	Y	H	8.5	Y		18548	70	30.08	50	3	96.0	4L	1500	0.5	94.0	4L	1350	2.0								
				H								2	97.0	4L	1400	0.5												
				H								4	94.0	4L	1350	0.5												
				L								3	94.0	4L	1500	0.5	92.0	4L	1400	2.0								
				L								2	95.0	4L	1500	0.5												
				L								4	92.0	4L	1400	0.5												
27-22	HH3 P38A4	F	Y	H	8.5	Y		7941	69	29.68	52	3	92.0	4L	1500	0.7	F				N	92.3	92.4	B	M	4L	1450	0.7
				H								2	94.0	4L	1500	0.7												
				H								4	89.0	4L	1500	0.7												
				L								3	89.0	4L	1450	0.7												
				L								2	91.0	4L	1450	0.7												
				L								4	88.0	4L	1500	0.7												
55-14	HJK T20A3	F	N		8.8	N + B + B		8188	60	29.74	56	3	95.0	3L	2200	1.0	92.5	3L	2200	2.0								
												2	96.0	3L	2200	1.0												
												4	93.0	3L	2200	1.0												
29-29	HJK T20A3	F	N		8.8	Y + B + B		13608	70	30.10	52	3	93.0	2U	3800	0.6	91.5	3U	2300	6.0	Y			A	M	2U	3800	0.6
												2	92.0	3U	2450	0.7												
												4	87.5	3L	2400	0.8												
29-21	HJK T20A3	F	N		8.8	Y + B + B		12237	70	30.20	63	3	92.0	2U	4450	0.6	89.0	2U	2700	1.6	Y	91.4	92.3	A	M	2U	4000	0.6
												2	95.0	2U	4500	0.6												
												4	87.0	2U	2800	0.6												
26-26	HJK T20A3	F	N		8.8	Y - B - B		13969	41	29.63	35	3	95.0	3L	2500	0.4	96.0	3U	2700	2.0	N	93.1	92.8	B	M	3L	2100	0.4
												2	94.0	3L	2500	0.4	98.0	3U	2900	2.0								
												4	91.0	3L	1500	0.4												
29-32	HNL P30A3	F	Y	H	9.0	Y		21497	70	30.10	52	3	87.0	2U	2500	0.6	85.0	3L	1600	4.0						N		
				H								2	90.0	2U	2400	0.6												
				H								4	87.0	3L	1700	0.9												
				L								3	87.0	2U	2500	0.6												
				L								2	88.0	2U	2500	0.6												
				L								4	87.0	3L	1700	0.9												

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE A I R	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMN	TANK FUEL INFORMATION RATED OCT RES	RATED OCT MOT	RATED INT	RATED TRP	RATED GEAR	RATED RPM	RATED MV
29-15	HNJ T25A3	F	N	9.0	Y		13943	70	30.00	57	3					96.0	3U	2450	3.0		91.6	82.0	A	M	3U	2400	0.6
											2	95.5	3L	1300	1.1											
											4	84.5	3U	2850	0.6											
66-03	HNJ T25A3	F	N	9.0	Y		14219	63	29.88	42	3					96.0	3L	1900	1.5								
											2					89.0	3L	2100	1.5								
											4					93.0	3L	1800	1.5								
26-08	HYBJ 215A3	F	N	9.4	Y	+ 5	+ 5	13354	64	30.14	36	3	94.0	3	3700	1.4					N	96.0	86.2	N				
											2	95.0	3	3700	1.4												
											4	92.0	3	2750	1.4												
41-03	HYBJ 215A3	C	N	9.4	N	+ 3	- 3	7757	69	30.31	45	3	90.0	3	2300	1.0					N	92.0	82.8	B	M	2	3000	1.0
											2	92.0	3	2400	1.0												
											4	88.0	3	2400	1.0												
60-04	HYBJ 215A3	F	N	9.4	N	+ 8	+ 5	6730	72	30.05	50	3	87.0	2	4200	1.2	95.0	3	2500	5.0	N	94.6	83.2	N				
											2	88.0	2	4000	1.2												
											4	86.0	3	3000	1.4												
05-10	HYBJ 215M5	F	N	9.4	Y	+ 5	+ 5	9343	71	30.20	32	3	90.5	4	1500	1.5	89.0	4	2500	2.5								
											2	91.0	4	1800	1.5	91.5	4	1500	8.0								
											4	90.5	4	1500	1.5												
26-05	HYBJ 215M5	F	N	9.4	Y	+ 5	+ 5	16163	70	30.01	53	3	88.0	4	1500	1.0	86.0	4	1700	2.5	N	91.7	83.1	N				
											2	88.0	4	1500	1.0												
											4	87.0	3	1450	1.0												
47-16	IA3 P38A4	C	Y	H	8.5	Y		9100	70	30.25	40	3	98.0	4L	1700	0.5	F											
				H								2	100.0	4L	1650	0.5												
				H								4	95.0	4L	1700	0.5												
				L								3	96.0	4L	1750	0.5												
				L								2	98.0	4L	1700	0.5												
				L								4	93.0	4L	1650	0.5												
09-01	IAR T25A3	F	N	8.8	Y		11109	78	29.91	32	3	94.0	3L	1375	4.0	93.0	3L	1650	8.0				B	M	3L	1350	4.0
											2	96.0	3L	1400	4.0	94.0	3L	1875	8.0								
											4	88.0	3L	1375	4.0	F											
05-09	IAR T25A3	F	N	8.8	Y	+ 8	+ 8	8730	72	30.10	26	3	89.0	3U	2300	1.0	91.0	3U	2150	4.0	N	96.6	88.6	N				
											2	91.0	3U	2300	1.0	93.0	3U	2450	3.5								
											4	86.0	3U	2550	1.0												
29-01	IAR T25A3	F	N	8.8	Y		16515	70	30.10	52	3	92.5	2U	3300	0.7	L							N				
											2	94.0	2U	3300	0.7												
											4	88.0	2U	3300	0.7												

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VEHICLE DESCRIPTION									WEATHER			OCTANE NUMBER REQUIREMENT DATA									TANK FUEL INFORMATION								
													MAXIMUM				PART THROTTLE							RATER					
						SPARK ADVANCE																OCT NO							
OBS NO	MODEL CODE	EMCT	KNK SEN		C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWNN	RES	MOT	NONT		GEAR	RPM	MV
06-15	IAW P28A3	F	Y	H	8.5	Y			6716	48	29.38	33	3	91.0	3L	2250	1.0	89.0	3L	2250	3.0	N	92.2	82.0	N				
				H									2	92.0	3L	2250	1.0	92.0	3L	2250	3.0								
				H									4	85.0	3L	1950	1.0												
				L									3	86.0	3L	2100	1.0												
				L									2	91.0	3L	2050	1.0												
				L									4	88.0	3L	1950	1.0												
65-07	IC3 P38A4	F	Y	H	9.5	Y			10625	66	29.14	48	3	89.0	3U	2000	0.0	86.0	4L	1300	2.5								
				H									2	89.0	3U	2000	0.0												
				H									4	88.0	3U	2000	0.0												
				L									3	85.5	3U	2000	0.0												
				L									2	87.5	3U	2000	0.0												
				L									4	87.5	3U	2000	0.0												
40-04	IC3 P38A4	F	Y	H	8.5	Y			10759	51	30.01	39	3	86.0	3U	1800	3.0								N				
				H									2	85.5	3U	1600	4.0												
				H									4	85.0	2U	2100	2.0												
				L									3	85.0	3U	1800	3.0												
				L									2	85.5	3U	1600	4.0												
				L									4	84.0	3U	1800	3.0												
60-09	IC3 P38A4	F	Y	H	8.5	Y			11603	58	29.96	48	3	89.0	3L	2350	0.9	87.0	4L	2000	4.0	N			N				
				H									2	88.0	3L	2300	0.9												
				H									4	88.0	3L	2400	0.9												
				L									3	86.0	4L	2000	0.8	87.0	4L	1900	4.0								
				L									2	87.0	4L	1800	0.8												
				L									4	87.0	4L	2050	0.8												
75-12	IC3 P38A4	F	Y	H	8.5	Y			13184	64	29.05	78	3	85.5	3U	2100	1.5	85.5	3U	1900	3.0				N				
				H									2	86.5	3L	1400	1.0												
				H									4	82.5	3U	1600	1.5												
				L									3	85.5	3U	2100	1.5	85.5	3U	1900	3.0								
				L									2	86.5	3L	1400	1.0												
				L									4	82.5	3U	1600	1.5												
08-09	IGA 238A3	F	Y	H	8.0	Y	+15	+15	15469	80	30.05	37	3	97.0	3U	1850	1.5	97.0	3L	1400	8.0				9	M	3U	1900	1.5
				H									2	98.0	3L	1575	1.8	98.0	3L	1475	8.0								
				H									4	90.0	3U	1900	1.5												
				L									3	90.0	3U	1950	1.5												
				L									2	92.0	3U	1900	1.5												
				L									4	89.0	3U	1900	1.8												

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OBS NO	MODEL CODE	EMC T	TANK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	SWAN	WATER OCT RES	WATER OCT MOT	WATER INT	WATER HOT	WATER GEAR	WATER RPM	WATER MV
46-17	IGA 238A3	F	Y	H	8.0	Y	+15	+15	19485	73	29.39	66	3				86.0	3U	1875	2.5		90.5	83.1	B	M	3U	1775	1.5
				H									2	90.0	2U	2000	1.5	91.0	3U	2000	2.5								
				H									4					88.0	3U	1875	2.5								
				L									3					81.0	2U	1975	2.5								
				L									2					-											
				L									4					L											
08-21	IGY 450A3	F	Y	H	8.0	Y	+20	+20	6623	80	29.63	29	3	86.0	3U	1950	1.5	82.0	3L	1400	10.0				N				
				H									2	88.0	2U	2250	0.5											
				H									4	85.0	2U	2200	0.5											
				L									3																
				L									2																
				L									4																
41-06	IGY 450A3	C	Y	H	8.0	Y	+22	+20	7967	65	30.01	60	3	86.0	2U	1800	1.0	91.0	2U	1400	8.0				N				
				H									2	88.0	3L	1400	3.5	93.0	3L	1200	8.0								
				H									4	85.0	2L	1300	1.0											
				-									3																
				L									2																
				L									4																
07-02	IGY 450A3	F	Y	H	8.0	Y	+20	+20	7777	70	30.14	61	3	98.0	2U	2050	0.5	96.0	3L	1800	8.0	Y	92.2	81.3	A	P	3L	1750	8.0
				H									2	100.0	2U	2250	0.6											
				H									4	92.0	2U	2300	0.6											
				L									3																
				L									2																
				L									4																
75-03	IGY 450A3	F	Y	H	8.0	Y	+20	+20	18310	61	29.24	72	3	98.5	3U	1900	6.5	98.5	3U	1900	7.0	N			N				
				H									2	99.0	3L	1500	8.0											
				H									4	94.5	2U	1900	2.0											
				L									3																
				L									2																
				L									4																
75-10	IGY 450A4	F	Y	H	8.0	Y	+20	+20	6079	65	29.01	70	3	95.0	2U	2000	0.0	F							N				
				H									2	86.0	2U	1900	0.0											
				H									4	84.0	2U	1800	0.0											
				L									3																
				L									2																
				L									4																

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OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNA	TANK FUEL OCT NO RES	TANK FUEL OCT NO MOT	RATED NINT	RATED T-P	RATED GEAR	RATED RPM	RATED MV
46-06	IHG P35A4	F	Y H	8.5	Y			10334	79	29.29	79	3	91.0	2U	1600	1.2	L				N	90.4	85.8	N				
			H									2	93.0	2U	1500	1.5												
			H									4	L															
			L									3	L				L											
			L									2	91.0	2U	1400	1.5												
			L									4	L															
40-11	INL P30A3	F	Y H	9.0	Y			10717	33	30.24	21	3	93.0	3L	2100	1.0	90.0	3L	2100	2.0				N				
			H									2	93.0	3U	3100	1.0												
			H									4	93.0	3L	2100	1.0												
			L									3	92.0	3L	2100	1.0												
			L									2	92.0	3L	2100	1.0												
			L									4	91.0	3L	2100	1.0												
07-19	INL P30A3	F	Y H	9.0	Y			9317	73	30.50	70	3	96.0	3L	1600	1.0	95.0	3L	1500	7.0	N	94.2	82.4	B	M	3L	1600	1.0
			H									2	96.0	3L	1550	1.0	96.0	3L	1600	7.0								
			H									4	95.0	3L	1550	1.0												
			L									3	93.0	3L	1500	1.0	91.0	3L	1500	7.0								
			L									2	93.0	3L	1550	1.0												
			L									4	93.0	3L	1600	1.0												
05-15	INU T25A3	F	N	9.0	Y			8935	69	29.85	50	3					94.0	3L	2750	7.0	N	94.6	87.0	N				
												2					96.0	3L	2750	7.0								
												4					93.0	3L	2750	7.0								
65-22	INU T25A3	F	N	9.0	Y			9750	49	29.65	46	3	92.0	3U	3000	1.0	92.0	3L	1900	4.0								
												2	95.0	3U	3000	1.0	95.5	3L	1900	4.0								
												4	90.0	3U	3000	1.0	90.0	3L	1900	4.0								
07-27	JA 315A4	F	N	9.2	N	+15	+15	10787	71	30.07	55	3	83.0	3	3200	1.5	79.0	3	2400	3.0	N	92.3	82.1	N				
												2	82.0	4	2900	1.5												
												4	82.0	4	2900	1.5												
35-07	JB 313M4	F	N	10.0	N	+14	+14	24723	72	30.00	26	3	93.0	4	2250	1.5	90.0	4	1950	2.5	N	91.2	83.5	B	M	4	2300	1.5
												2	93.0	4	2350	1.5												
												4	93.0	4	1300	1.5												
62-02	JB 315A4	F	N	9.2	N	+15	+15	6461	72	30.21	47	3	85.0	3	3100	1.3	82.0	4	2700	3.0	N	93.0	81.6	N				
												2	87.0	4	3200	1.4												
												4	81.0	3	3700	1.3												
41-26	JB 315A4	F	N	9.2	[illegible]	+15	+15	21442	69	30.29	24	3	86.0	3	2700	1.5	F					92.4	83.0	N				
												2	98.0	3	2900	1.5												
												4	84.0	3	2700	1.5												

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OBS NO	MODEL CODE	EMC/T	KNK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNK	WATER OCT NO RES	WATER OCT NO MOT	WATER INT/THR	WATER GEAR	WATER RPM	WATER MV
29-27	JB 315M5	F	N	8.2	Y	+20	+20	7110	70	30.10	52	3	H				H				Y			A	M 4	1600	0.4
												2	H														
												4	H														
60-07	JC 220A4	F	N	9.1	Y	+17	+17	7873	68	30.25	55	3	86.0	3L	2700	2.5	82.0	4L	2550	1.5	N	84.0	83.2	N			
												2	86.0	4L	3250	2.6											
												4	85.0	3L	3000	2.5											
41-15	JC 220A4	C	N	9.1	Y	+15	+15	6160	75	30.10	62	3	84.0	3U	2500	2.0					N			N			
												2	84.0	4U	3000	2.0											
												4	82.0	4U	2600	2.0											
05-27	JC 220M5	F	N	9.1	Y	+24	+24	7278	69	30.82	50	3	89.0	4	2250	1.7	F				N			N			
												2	91.0	4	2350	1.8											
												4	96.0	4	2200	1.7											
46-05	JC 220M5	F	N	9.1	Y	+24	+24	16245	75	29.91	62	3	89.0	4	1625	2.0	86.0	4	1900	3.0	N	92.0	88.3	B	M 4	1600	2.0
												2	90.0	3	2350	2.0											
												4	88.0	4	2000	2.0											
29-01	JC P20A4	F	N	9.8	Y	+15	+15	11291	70	30.10	57	3	86.0	4U	3000	0.2	85.5	3U	2400	3.0	N	95.8	87.0	N			
												2	86.5	3U	3300	0.2											
												4	82.5	2U	3000	0.2											
06-04	JC P20M5	F	N	8.8	Y	+15	+15	25900	67	29.97	54	3	90.0	4	2600	0.6					N	98.9	87.8	N			
												2	91.0	4	2650	0.6											
												4	91.0	4	2400	0.6											
46-20	JC P20M5	F	N	8.8	Y	+15	+15	6004	74	29.80	64	3	97.0	4	2450	0.5	84.0	4	1650	1.5	N	94.9	82.6	N			
												2	86.0	4	2600	0.5											
												4	86.0	4	2600	0.5											
25-02	KGETP22M5	F	Y	H	8.1	Y	+12	+12	15444	70	29.56	50	3	90.0	4	2600	-10.0	F						N			
				H								2	91.0	4	2600	-10.0											
				H								4	92.0	4	2600	-10.0											
				L								3	88.0	4	2600	-10.0											
				L								2	88.0	4	2600	-10.0											
				L								4	87.0	4	2600	-10.0											
25-01	KHK T25A3	F	N		9.0	Y	+12	+12	15945	70	29.55	50	3	85.0	3U	2000	2.0	81.0	3L	2100	3.0				N			
												2	86.0	3U	2000	2.0											
												4	93.0	3U	2000	2.0											
06-06	KKD T22A3	F	N		9.5	Y	+12	+12	23589	51	29.77	28	3	91.0	3	2700	0.6	80.0	3	2300	2.0	N	93.5	82.8	N			
												2	91.0	3	2700	0.6											
												4	90.0	3	2400	0.5											

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OBS NO	MODEL CODE	ENG CT	KNK SEN	SPARK ADVANCE C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMMENTS	TANK FUEL INFORMATION OCT NO RES	OCT NO MOT	RATER INT	RATER THR	RATER GEAR	RATER RPM	RATER MV
47-15	KKD T22A3	C	N	9.5	Y	+12	+12	9000	70	30.01	48	3	87.0	3	2100	0.5												
												2	89.0	3	2500	0.5												
												4	87.0	3	2800	0.5												
25-09	KKD T22A3	F	N	9.5	Y	+12	+12	19179	70	29.41	50	3	84.0	2	2000	0.5	81.5	3	1900	2.0				N				
												2	85.0	2	2000	0.5												
												4	84.0	2	2000	0.5												
08-23	KLC 222A3	A	N	9.0	N	+10	+10	8552	78	29.49	48	3	89.0	2	3500	1.2	F							B	M	2	3600	1.2
												2	92.0	2	3500	1.2												
												4	92.0	2	2800	1.2												
05-30	KLC 222A3	F	N	9.0	Y	+10	+10	18222	73	30.53	52	3	87.0	3	2400	3.8	F					N	91.7	82.3	N				
												2	89.0	3	2325	4.0												
												4	84.0	3	2800	1.8												
26-01	KLC 222A3	F	N	9.0	Y	+10	+10	19046	69	30.38	54	3	95.0	3	2000	1.5	93.0	2	1800	3.0		N	87.8	87.1	N				
												2	96.0	2	1900	1.8	96.0	3	1800	7.0								
												4	88.0	3	2400	1.5												
40-01	KLC 222A3	F	N	9.0	N	+10	+10	15808	60	29.47	62	3					88.0	3		10.0				N				
												2					88.5	3	1500	10.0								
												4	85.5	3	2500													
25-10	KLC 222M5	F	N	9.0	N	+10	+10	8651	70	29.34	50	3	87.0	4	1300	0.5	84.0	4	1300	2.0				N				
												2	86.0	4	1300	0.5												
												4	86.0	4	1500	0.5												
05-19	KMP 252A3	F	Y	H	9.1	Y	+ 7	+ 7	8811	71	30.20	24	3	89.0	2U	3100	2.5	89.0	2U	1100	5.0		N	95.2	87.0	N				
				H								2	89.0	2U	3100	2.5	90.0	2U	1150	5.0								
				H								4	86.0	2U	1100	2.5	87.0	2U	1500	5.0								
				L								3	86.0	2U	3050	2.5												
				L								2	88.0	2U	3100	2.5	88.0	2U	1150	5.0								
				L								4	83.0	2U	1500	2.5	83.0	2U	1500	5.0								
25-05	KPD T22A3	F	N	9.5	Y	+12	+12	12715	70	29.66	50	3	90.0	3	2050	0.5	88.0	3	1800	3.0				N				
												2	90.0	3	2100	0.5												
												4	88.0	3	2100	0.5												
09-03	KPD T22A3	A	N	9.5	Y	+12	+12	10835	78	30.00	40	3	88.0	3	1950	1.5	89.0	3	1150	11.0				B	P	3	1150	11.0
												2	88.0	3	2000	1.5	90.0	3	1300	11.0								
												4	86.0	2	2200	0.5												
46-11	KPD T22A3	F	N	9.5	Y	+12	+12	15167	74	29.39	78	3	85.0	2	2000	1.0	83.0	3	2000	2.0		N						
												2	83.0	2	2250	1.0												
												4	82.0	2	2100	1.0												

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OBS NO	MODEL CODE	EMI CTL	ENA SEN	C.R.	EI P	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION CWK	RATED OCT RES	RATED NO MOT	RATED NVT	RATED HTP	RATED GEAR	RATED RPM	RATED MV
25-04	KPETP22A3	F	Y H	8.1	Y	+12	+12	15800	70	29.61	50	3	95.0	3	2450	-4.0	95.0	3	2400	-3.0				N				
			H									2	95.0	3	2600	-4.0												
			H									4	95.0	3	2600	-4.0												
			L									3	93.0	3	2400	-4.0	93.0	3	2500	-3.0								
			L									2	93.0	3	2375	-4.0												
			L									4	93.0	3	2550	-4.0												
28-34	KPETP22A3	F	Y H	8.1	Y	+12	+12	10556	70	29.18	50	3	92.0	3	2800	1.0					N			N				
			H									2	90.0	3	2800	1.0												
			H									4	89.0	3	2800	1.0												
			L									3	91.0	3	2800	1.0												
			L									2	89.0	3	2800	1.0												
			L									4	89.0	3	2800	1.0												
63-01	KICK 215A3	F	N	9.4	Y	0	+ 5	7017	70	29.69	50	3	86.0	2	2500	2.0	84.0	2	2200	3.5				N				
												2	87.0	2	2500	2.0												
												4	86.0	2	2500	2.0												
06-03	KICK 215M4	F	N	9.4	N	+ 5	+ 5	21527	55	29.45	47	3	93.0	4U	1500	0.8	96.0	3U	1500	7.0	N	93.3	82.0	A	P	3U		
												2	93.0	3U	1500	0.6	97.0	3U	1600	7.0								
												4	93.0	4U	1500	0.8												
08-32	LAP T25A3	F	N	8.3	Y			12275	80	29.63	37	3	90.0	3U	2700	1.0	89.0	3L	2250	5.0				N				
												2	92.0	3U	2500	1.0	90.0	3L	2300	5.0								
												4	85.0	2U	3100	1.0												
05-29	LAW P28A3	F	Y H	9.9	Y			8170	68	30.45	50	3	84.0	3L	1900	1.6	F				N	92.1	82.5	N				
			H									2	85.0	3L	1950	1.6												
			H									4	82.0	3L	2000	1.6												
			L									3	84.0	3L	1900	1.6	F											
			L									2	85.0	3L	1950	1.6												
			L									4	82.0	3L	2000	1.6												
07-21	LAW P28A3	F	Y H	8.9	Y			15800	70	29.64	42	3	87.0	3U	1850	2.3	F				N	92.3	82.4	B	M	3U	1900	2.3
			H									2	89.0	2U	2250	1.4												
			H									4	85.0	2U	2500	1.4												
			L									3	87.0	3U	1850	2.3	F											
			L									2	88.0	3U	1900	2.3												
			L									4	85.0	2U	2500	1.4												

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VEHICLE DESCRIPTION										WEATHER				OCTANE NUMBER REQUIREMENT DATA								TANK FUEL INFORMATION							
							SPARK ADVANCE							MAXIMUM				PART THROTTLE								RATED			
OBS NO	MODEL CODE	EMC T	KNK SEN		C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWNNA	OCT NO RES	OCT NO MOT	NINT	THR	GEAR	RPM	MV
62-03	LAW P28A4	F	Y	H	8.3	Y			26932	70	30.71	44	3	82.0	3U	2900	1.7	79.0	4L	2100	4.0	N	84.2	82.7	B	M	3L	2400	1.8
				H									2	86.0	3L	2400	1.8												
				H									4	80.0	3U	2900	1.7												
				L									3	82.0	3U	2900	1.7	79.0	4L	2100	4.0								
				L									2	82.0	3L	2900	1.8												
				L									4	80.0	3U	2900	1.7												
46-07	LC3 P38A4	F	Y	H	8.5	Y			8670	75	29.70	67	3	L				L				Y	90.3	82.4	N				
				H									2	L				L											
				H									4	L				L											
				L									3	L				L											
				L									2	L				L											
				L									4	L				L											
47-30	LG7TP38A4	C	Y	H	8.0	Y			8000	70	30.90	50	3	99.5	2U	3800	-11.0												
				H									2	99.5	2U	3800	-11.0												
				H									4	99.5	2U	3800	-11.0												
				L									3	99.0	2U	3800	-11.0												
				L									2	99.0	2U	3800	-11.0												
				L									4	99.0	2U	3800	-11.0												
C5-18	LGA 239A3	F	Y	H	8.0	Y	+12	+12	6831	70	29.85	50	3	94.0	3L	1575	1.0	F				N	92.3	82.6	A	M	3L	1500	1.0
				H									2	95.0	3L	1400	1.0												
				H									4	92.0	3L	1400	1.0												
				L									3	93.0	3L	1500	1.0												
				L									2	94.0	3L	1400	1.0												
				L									4	92.0	3L	1400	1.0												
75-09	LGY 450A4	F	Y	H	8.0	Y	+20	+20	6681	71	29.11	66	3	84.5	3L	2000	1.5	F							N				
				H									2	85.5	3L	1800	1.5												
				H									4	83.5	3L	2200	1.5												
				L									3	84.5	3L	2000	1.5	F											
				L									2	85.5	3L	1800	1.5												
				L									4	83.5	3L	2200	1.5												
29-10	LH3 P38A4	F	Y	H	8.5	Y			15987	70	29.31	50	3	85.0	2U	1850	0.5	F							N				
				H									2	86.0	2U	1900	0.5												
				H									4	83.0	2U	1900	0.5												
				L									3	83.0	2U	1900	0.5												
				L									2	84.0	2U	2000	0.5												
				L									4	81.0	2U	1900	0.5												

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OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMPUTER KNOCK	WATER OCT PRES	WATER OCT MOT	WATER INT	WATER GEAR	WATER RPM	WATER MV
28-11	LH3 P38A4	F	H	8.5	Y			15932	70	29.32	50	3	86.0	2U	1700	0.5	F							N			
			H									2	86.0	2U	1700	0.5											
			H									4	88.0	2U	1700	0.5											
			L									3	84.0	2U	1700	0.5											
			L									2	84.0	2U	1700	0.5											
			L									4	81.0	2U	1700	0.5											
05-21	LH3 P38A4	F	Y	H	8.5	Y		7352	70	30.00	30	3	85.0	4L	1250	1.0	82.0	4L	1300	3.0	N	96.3	86.3	N			
				H								2	86.0	4L	1250	1.0	86.0	4L	1300	3.0							
				H								4	84.0	4L	1250	1.0											
				L								3	82.0	4L	1300	1.0											
				L								2	82.0	4L	1300	1.0											
				L								4	83.0	4L	1250	1.0											
07-11	LJ1 T20A3	F	N		9.0	Y		11332	71	30.31	68	3	91.0	3L	2200	2.1	89.0	3L	2200	7.0	N	92.8	84.3	N			
												2	94.0	3L	2200	2.1	95.0	3L	2400	7.0							
												4	98.0	3U	2900	0.8											
05-29	LJK T20A3	F	N		8.8	Y	+ 8 + 8	6105	70	29.98	50	3	84.0	3L	2700	1.0	F				N	92.5	81.7	N			
												2	86.0	3L	2600	1.0											
												4	82.0	3L	3300	1.0											
28-01	LNK T20A3	F	N		9.0	Y	+ 8 + 8	16170	70	29.72	50	3	91.0	2U	2800	0.5	F							B	M	2U	2900	0.5
												2	91.0	2U	3000	0.5											
												4	87.0	2U	2900	0.5											
28-27	LNL P30A3	F	Y	H	9.0	Y		15422	70	29.36	50	3	83.0	2U	2400	2.0	83.0	3U	2150	4.0				N			
				H								2	83.0	2U	2350	2.0											
				H								4	83.0	2U	2500	2.0											
				L								3	80.0	2U	2000	2.0	80.0	3U	2000	4.0							
				L								2	80.0	2U	2200	2.0											
				L								4	80.0	2U	1500	2.0											
08-05	LNU T25A3	F	N		9.0	Y		18234	82	29.85	51	3	85.0	3L	1350	3.0	85.0	3L	1250	5.0				N			
												2	86.0	3L	1550	3.0											
												4	81.0	3L	1350	3.0											
07-12	LNU T25A3	F	N		9.0	Y		9232	74	30.06	55	3	94.0	3U	2900	1.5	94.0	3L	2100	5.5	N			A	M	3U	2900	1.5
												2	97.0	3L	2050	1.8	98.0	3L	2100	5.5							
												4	92.0															
41-30	LNU T25A3	C	N		9.0	Y	+ 5 + 8	33431	70	30.18	54	3	86.0	3L	1300	2.0	F					93.0	82.9	B	M	3L	1400	2.0
												2	87.0	3L	1800	2.0											
												4	85.0	3L	1300	2.0											

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE AIR	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMMENTS	TANK FUEL INFORMATION OCT NO PRES	OCT NO MOT	RATER INITIAL	RATER THR	RATER GEAR	RATER RPM	RATER MV
32-20	MPF P50A4	F	N	8.9	+10	+10	12803	70	29.71	50	3	85.0	4	1600	1.5	85.0	4	1750	3.0	N			N				
											2	86.0	4	1400	1.5	86.0	4	1500	3.0								
											4	85.0	4	1600	1.5	L											
32-05	MPF P50A4	F	N	8.9	+ 9	+10	15306	70	29.27	50	3	89.0	4	1600	1.8	88.0	4	1500	3.0	N			N				
											2	91.0	4	1500	1.8	90.0	4	1500	3.0								
											4	90.0	4	1500	1.8	89.0	4	1500	3.0								
41-01	MRU P30A4	C	Y	H	9.3	Y	+10	+10	21275	70	30.05	62	3	85.0	4L	1300	1.5										
				H								2	85.0	4L	1400	1.5											
				H								4	84.0	4L	1300	1.5											
				L								3	84.0	4L	1400	1.5											
				L								2	84.0	4L	1400	1.5											
				L								4	84.0	4L	1400	1.5											
46-02	MRU P30A4	F	Y	H	9.3	Y	+10	+10	6514	79	29.21	70	3	81.0	3U	1750	1.5	81.0	4L	1550	2.5	N	91.1	83.6	N				
				H								2	82.0	3U	2100	1.5	81.0	4L	1650	2.5								
				H								4	80.0	3U	2400	1.5											
				L								3	L				L											
				L								2	81.0	4L	1650	1.5	81.0	4L	1650	2.5								
				L								4	80.0	3U	2400	1.5											
32-22	MRU P30A4	F	Y	H	9.3	Y	+10	+10	22426	70	29.56	50	3	88.0	4L	1400	0.8	88.0	4L	1400	2.0	N			B	M	4L	1500	0.8
				H								2	89.0	4L	1400	0.8	89.0	4L	1400	2.0								
				H								4	88.0	4L	1400	0.8	88.0	4L	1400	2.0								
				L								3	87.0	4L	1500	0.8	87.0	4L	1500	2.0								
				L								2	88.0	4L	1500	0.8	87.0	4L	1600	2.0								
				L								4	87.0	4L	1500	0.8	87.0	4L	1500	2.0								
08-26	MS3 T38A4	F	N		8.7	Y	+10	+10	16574	78	29.23	40	3	87.0	4U	1400	2.0	87.0	4U	1250	5.0				N				
												2	89.0	4U	1400	2.0												
												4	86.0	4U	1550	2.0												
41-[illegible]	MS3 T38A4	C	N		8.7	Y	+10	+10	24052	69	30.33	29	3	87.0	3L	1200	1.0	F							N	M			
												2	85.0	3L	1300	1.0												
												4	88.0	3L	1100	1.0												
62-06	MSF P50A4	F	N		8.9	Y	+10	+10	10507	63	30.30	73	3	86.0	3L	2600	0.8	82.0	4L	1900	3.0	N	32.3	82.1	N				
												2	88.0	3L	2100	0.8												
												4	87.0	4L	1300	0.8	87.0	4L	1300	0.8								
09-19	MTx T23A3	F	N		9.0	Y	+10	+10	7240	76	29.69	34	3	88.0	2	3000	1.0	84.0	3	2200	5.0				N				
												2	90.0	3	2450	2.0												
												4	86.0	2	3200	1.0												

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OBS NO	MODEL CODE	EMIS	MAN SEN	SPARK ADVANCE C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMMENTS	RATER OCT NO RES	RATER OCT NO MOT	RATER INT	RATER GEAR	RATER RPM	RATER MV
30-26	MTX T23A3	F	N	9.0	Y	+10	+10	9456	70	29.45	50	3	86.0	3	2700	1.2	86.0	3	2500	2.0	N			N			
												2	87.0	3	2500	1.2	87.0	3	2800	2.0							
												4	86.0	3	2700	1.2											
32-23	MTX T23M5	F	N	9.0	Y	+11	+10	10600	70	29.77	51	3	88.0	4	1700	0.5	88.0	4	2000	2.0	N			N			
												2	89.0	4	1700	0.5	89.0	4	2000	2.0							
												4	89.0	4	1700	0.5	88.0	4	2000	2.0							
65-04	MTX T23M5	F	N	9.0	Y	+10	+10	9438	57	29.33	42	3	93.5	3	3400	0.5	93.0	3	2000	5.0							
												2					94.5	3	3000	0.5							
												4	90.5	3	3600	0.5											
63-03	MIBD 220A3	F	N	8.5	Y	+ 8	+ 8	32943	70	29.44	50	3	87.0	2	2200	1.0	83.0	2	2900	2.0				N			
												2	87.0	2	2300	0.8											
												4	83.0	2	2200	1.0											
62-05	MIBD 220A3	F	N	8.5	Y	+ 5	+ 5	9111	73	29.58	66	3	85.0	3	2900	1.5	F				N			N			
												2	87.0	3	2700	1.5											
												4	83.0	3	2900	1.5											
63-02	MIDL P24A4	F	N	8.5	Y	+ 5	+ 5	13633	70	29.84	50	3	88.0	4L	1500	0.8	87.0	4L	1400	0.8				N			
												2	89.0	4L	1450	0.8											
												4	85.0	4L	1500	0.8											
28-18	NAR T25A3	F	N	8.3	Y			13570	70	29.26	50	3	87.0	3L	1500	1.0	85.0	3L	1550	3.5				A	P	2U	1100	5.0
												2	89.0	3L	1800	1.0											
												4	84.0	3L	1500	1.0											
08-12	NAR T25A3	F	N	8.3	Y			6702	80	29.51	50	3	92.0	3L	1350	3.5	90.0	3L	1325	7.0				B	M	3U	2425	1.5
												2	93.0	3L	1350	3.5	93.0	3L	1450	7.0							
												4	96.0	3L	1325	3.5											
08-22	NAR T25A3	F	N	8.3	Y			11314	80	29.95	21	3	93.0	3L	1425	3.0	93.0	3L	1475	5.0				A	M	3L	1400	3.0
												2	94.0	3L	1450	3.0	95.0	3L	1525	5.0							
												4	90.0	3L	1700	2.2											
06-07	NAR T25A3	F	N	8.3	Y			17590	52	29.86	33	3	91.0	3U	3000	0.8	95.0	3U	2400	4.0	N	93.0	82.6	N			
												2	92.0	3L	2100	1.5	97.0	3L	2500	4.0							
												4	85.0	3U	2500	1.0											
41-04	NAR T25A3	C	N	9.3	Y			22460	70	30.10	81	3	93.0	3L	1300	1.5	92.0							A	M	3L		
												2	95.0	3L	1300	1.5											
												4	90.0	3L	1400	1.5											
65-13	NAR T25A3	F	N	8.3	Y			8688	65	29.78	48	3					94.5	3U	2000	3.5							
												2	93.0	2U	2000	0.0	94.5	3U	2000	3.5							
												4	90.0	2U	2500	0.0	90.0	3U	2000	3.5							

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OBS NO	MODEL CODE	EMC T	ANR SEN	A/I R	C.R.	SPARK ADVANCE RCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAX OCT NO	MAX GEAR	MAX RPM	MAX MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	CONK	OCT NO RES	OCT NO MOT	RATER INIT	RATER GEAR	RATER RPM	RATER MV
40-12	NAR T25A3	F	N		8.3	Y		13936	37	30.01	23	3	93.0	3L		1.0	93.5	3L		2.0				A	M	3U	1.0
												2	96.5	3U		1.0	99.0	3L		2.0							
												4	92.0	3L		1.0											
07-09	NAR T25A3	F	N		8.3	Y		11544	70	30.35	66	3	95.0	3L	2200	1.7	99.0	3L	2500	4.0	N	95.2	94.3	A	P	3L	2400	4.0
												2	97.0	3L	2200	1.7	101.0	3L	2500	4.0							
												4	89.0	3L	2100	1.7	89.0	3L	2300	4.0							
40-03	NAR T25A3	F	N		8.3	Y		10432	54	30.10	35	3	96.0	3U		3.0	97.5	3L		4.0				A	P	3L	4.0
												2	97.5	3U		4.0	100.0	3L		4.0							
												4	92.0	3U		4.0											
47-01	NAR T25A3	C	N		8.3	Y		22290	70	30.06	50	3	94.0	3L	2400	1.0	96.0	3L	1400	3.0							
												2	94.0	3L	2400	1.0											
												4	87.0	3L	2400	1.0											
28-02	NAW P28A3	F	Y	H	8.9	Y		15932	70	29.37	50	3	82.0	2U	2000	1.3	L								N		
				H								2	85.0	2U	2000	1.3											
				H								4	81.0	2U	2000	1.3											
				L								3	82.0	2U	2000	1.3	L										
				L								2	85.0	2U	2000	1.3											
				L								4	81.0	2U	2000	1.3											
41-18	NAW P28A3	C	Y	H	8.9	Y		22356	70	30.36	56	3	94.0	3L	1600	3.0									N		
				H								2	95.0	3L	1600	3.0											
				H								4	88.0	3L	1600	3.0											
				L								3	94.0	3L	1600	3.0											
				L								2	94.0	3L	1600	3.0											
				L								4	88.0	3L	1600	3.0											
08-31	NAW P28A4	F	Y	H	8.9	Y		10236	79	29.79	39	3	89.0	3L	1750	2.5	89.0	3L	1525	5.0					N		
				H								2	92.0	3L	1800	2.5	92.0	3L	1550	5.0							
				H								4	83.0	3L	1800	2.5											
				L								3	88.0	3L	1900	2.5											
				L								2	90.0	3L	1900	2.5											
				L								4	82.0	3L	1900	2.5											
75-02	NAW P28A4	F	Y	H	8.9	Y		8976	64	29.31	66	3	85.0	3L	1900	5.0	F										
				H								2	85.5	2U	1700	1.0	85.5	3U	2000	6.0							
				H								4	83.5	2U	1900	1.0											
				L								3	85.0	3L	1900	6.0	F										
				L								2	85.5	2U	1700	1.0	85.5	3U	2000	6.0							
				L								4	83.5	2U	1900	1.0											

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OBS NO	MODEL CODE	EMCT	ENGN SEN	C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWN TANK FUEL	OCT NO PRES	OCT NO MOT	INTK THRTL POS	GEAR RATIO	RPM	MV
08-02	NBH 450A4	F	Y H	9.3	Y	0	0	8756	79	30.13	34	3	100.0	2U	3050	0.6	99.0	4L	1050	10.0				A	M	4L	1000	1.5
			H									2	101.0	3U	3400	0.6	98.0	4L	1000	10.0								
			H									4	95.0	3L	2100	2.5												
			L									3	98.0	2U	3300	0.6												
			L									2	100.0	2U	3350	0.6												
			L									4	94.0	3U	2200	2.5												
08-24	NBH 450A4	F	Y H	9.3	Y	0	0	10177	79	30.01	14	3	93.0	2U	3250	1.0	93.0	3L	950	8.0				A	M	2U	3250	1.0
			H									2	95.0	2U	3250	1.0	95.0	3L	1050	8.0								
			H									4	91.0	3U	1950	2.5	90.0	3L	950	8.0								
			L									3	92.0	2U	3250	1.0												
			L									2	94.0	2U	3250	1.0												
			L									4	90.0	3U	1950	2.5												
28-33	NBH 450A4	F	Y H	9.3	Y	0	0	8099	70	29.75	50	3	95.0	2U	1800	0.5	L							B	M	2U	1800	0.5
			H									2	95.0	2U	1900	0.5												
			H									4	94.0	2U	1750	0.5												
			L									3	94.0	2U	1800	0.5												
			L									2	94.0	2U	1700	0.5												
			L									4	94.0	2U	1750	0.5												
28-11	NBH 450A4	F	Y H	9.3	Y	0	0	12683	61	29.04	76	3	88.5	2U	1700	0.5	F							N				
			H									2	90.0	3L	1600	1.5												
			H									4	87.5	4L	1500	1.5												
			L									3																
			L									2																
			L									4																
08-19	NBZ 743A4	F	Y H	9.3	Y	0	0	8804	79	29.80	47	3	93.0	2U	2050	0.5	F							A	M	2U	2200	0.5
			H									2	94.0	2U	2150	0.5												
			H									4	90.0	2U	2250	0.5												
			L									3	92.0	2U	2100	0.5												
			L									2	93.0	2U	2200	0.5												
			L									4	89.0	2U	2100	0.5												
08-27	NBZ 743A4	F	Y H	9.3	Y	0	0	7833	80	29.39	17	3	101.0	3L	1800	2.0	101.0	4L	1350	9.0				A	M	3L		1.5
			H									2	101.0	3L	1850	2.0	102.8	4L	1350	9.0								
			H									4	97.0	4L	1450	2.0	98.0	4L	1350	9.0								
			L									3	100.0	3L		1.0	100.0	4L		9.0								
			L									2	99.0	3L		2.0												
			L									4	96.0	4L	1400	2.0												

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OBS NO	MODEL CODE	EMI CNT	KNK SEN	C.R.	SPARK ADVANCE AI P	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION	RATER OCT NO PES	RATER OCT NO MOT	RATER GRADE	RATER GEAR	RATER RPM	RATER MV
75-05	NFH 450A4	F	Y H	8.9	Y	0	0	9311	67	28.45	70	3	97.5	3U	1700	4.0	97.5	3L	1225	5.0				A	M	2U	1500	4.0
			H									2	97.5	2U	2000	2.0												
			H									4	95.5	2U	2000	2.0												
			L									3	97.5	3U	1700	4.0	97.5	3L	1225	5.0								
			L									2	97.5	2U	2000	2.0												
			L									4	95.5	2U	2000	2.0												
28-13	NFS P28A4	F	Y H	8.9	Y	+10	+10	33549	70	.	50	3	L				L						N					
			H									2	L				L											
			H									4	75.0	2U	2900	0.5												
			L									3	L															
			L									2	L															
			L									4	L															
05-05	NFS P28A4	F	Y H	8.9	Y	+11	+11	6050	70	30.20	19	3	94.0	2U	3800	0.5	F				N	96.0	96.3	B	M	2U	3900	0.5
			H									2	96.0	2U	3850	0.5												
			H									4	90.0	2U	3800	0.5												
			L									3	93.0	2U	3850	0.5												
			L									2	95.0	2U	3800	0.5												
			L									4	89.0	3U	3450	1.0												
28-04	NGH 450A4	F	Y H	9.3	Y	0	0	9558	70	29.99	53	3	95.0	3U	1550	1.5	F				N	92.4	93.1	B	M	2U	2250	1.0
			H									2	96.0	3U	1550	1.5												
			H									4	92.0	3U	1550	1.5	F											
			L									3	90.0	2U	1550	1.0												
			L									2	90.0	3U	1550	1.5												
			L									4	88.0	2U	1550	1.0												
28-05	NJ1 T20A3	F	N	9.0	Y			14102	70	29.41	50	3	87.0	2U	2300	0.5	84.0	2U	2300	1.5					N			
												2	88.0	2U	2450	0.5												
												4	85.0	2U	2600	0.5												
28-06	NJ1 T20A3	F	N	9.0	Y			14804	70	29.41	50	3	87.0	3L	1550	2.5	85.0	3L	1550	3.5					N			
												2	89.0	3L	1500	2.5												
												4	85.0	2U	2600	0.5												
08-10	NJ1 T20A3	F	N	9.0	Y			8517	80	29.94	21	3	89.0	3L	1550	4.0	88.0	3L	1550	8.0					N			
												2	90.0	3L	1550	4.0	90.0	3L	1525	8.0								
												4	85.0	3U	2750	1.5												
08-13	NJ1 T20A3	F	N	9.0	-			8410	80	29.78	29	3	88.0	3U	3050	1.0	84.0	3L	1600	5.0					N			
												2	89.0	2U	3000	1.0												
												4	85.0	2U	1950	1.0												

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OBS NO	MODEL CODE	EMCT	ANA SEN	C.R.	AIR	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMMENTS	WATER OCT RES	WATER OCT MOT	WATER INT TYP	WATER GEAR RPM	WATER MV
06-19	NU1 T20A3	F	N	9.0	Y			4294	37	30.21	19	3	88.0	3L	1550	1.0	87.0	3L	1700	1.0	N	92.9	92.3	B	3L	1600	1.0
												2	89.0	3L	1400	1.0											
												4	85.0	3L	2600	1.0											
29-16	NU1 T20A3	F	N	9.0	Y			18385	70	30.00	57	3					86.0	2U	2500	1.5				N			
												2	88.0	3U	2600	0.5											
												4	87.0	2U	2600	0.4											
40-14	NU1 T20A3	F	N	9.0	Y			13433	33	30.22	24	3	89.5	3L		1.0	89.0	3L		3.0				N			
												2	91.0	3L		1.0											
												4	88.5	3L		2.0	89.0	3L		3.0							
07-08	NU1 T20A3	F	N	9.0	Y			12461	72	29.85	66	3	88.0	3U	2200	1.5	88.0	3U	2500	4.0	N	93.6	82.0	N			
												2	90.0	3U	2200	1.5	91.0	3U	2250	4.0							
												4	85.0	3U	2500	1.5											
40-05	NU1 T20A3	F	N	9.0	Y			18852	55	30.09	47	3	91.5	2U		1.0	F							N			
												2	91.5	2U		1.0											
												4	88.0	2U		0.5											
55-01	NU1 T20A3	F	N	9.0	N			22094	67	29.14	66	3	92.0	2U	2200	0.0	89.0	3L		2.0							
												2	91.5	2U	2900	0.0											
												4	89.0	2U	2800	0.0											
06-24	NU1 T20A3	F	N	9.0				10177	19	30.35	6	3	87.0	3U	2850	0.4	86.0	3U	2400	1.4	N	94.9	83.6				
												2	89.0	3U	3100	0.4											
												4	85.0	3U	2900	0.4											
06-27	NU1 T20A3	F	N	9.0	Y			17509	35	29.79	20	3	93.0	3L	2600	0.4	94.0	3L	2800	4.0	N	93.0	83.0	B	M	3L	2500	0.4
												2	95.0	3L	2800	0.4	97.0	3L	2900	4.0							
												4	89.0	3L	2550	0.4	93.0	3L	2500	4.0							
29-07	NUM P29A3	F	Y	H	8.9	Y		11122	70	30.10	62	3					100.0	2U	3600	5.0	Y	95.8	87.0	A	P	3U	3300	5.0
				H								2					101.5	2U	3000	5.0							
				H								4	98.0	3L	2200	1.3											
				L								3					100.0	2U	3800	5.0							
				L								2					101.0	2U	3000	5.0							
				L								4	98.0	3L	2200	1.3											
07-13	NTC 216A3	F	N	9.0	N	+ 5	+ 5	7728	72	30.24	50	3	93.0	3U	3200	0.8	F				O	92.3	92.1	A	M	2U	3500	0.8
												2	96.0	3L	3050	1.8											
												4	88.0	3U	3000	0.8											
41-14	NZA5 210M5	C	N	9.5	N	+10	+10	29958	73	30.16	69	3	93.0	4	1300	1.0					Y			B	M	3	2200	1.0
												2	94.0	4	1400	1.0											
												4	92.0	4	1300	1.0											

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OBS NO	MODEL CODE	EMC T	ENGINE DESIGN	A/F SYS	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	COMPARISON NOT	RATER OCT RES	RATER OCT MOT	RATER INT TYP	RATER HIS TYP	RATER RPM	RATER MV
08-16	NUA4 216A3	A	N	9.0	Y	+ 5	+ 5	10508	76	29.61	52	3	94.0	2U	3800	0.6	F						B	M	3L	1950	3.2
												2	96.0	2U	3800	0.6											
												4	90.0	3L	2050	2.2											
47-26	NUA4 216A3	C	N	9.0	Y	+10	+ 5	15000	70	30.14	50	3	90.0	3L	3300	1.0	86.0	3L	2900	2.0							
												2	93.0	3L	3300	1.0											
												4	86.0	3L	3100	1.0											
41-25	NUA4 216A3	C	N	9.0	Y	+ 5	+ 5	12470	69	30.12	53	3	88.0	2U	3600	2.0								N			
												2	88.0	2U	3100	2.0											
												4	87.0	2U	3100	2.0											
07-14	NUA4 216A3	F	N	9.0	N	+ 5	+ 5	6029	70	30.20	48	3	89.0	3U	2300	0.8	F				N	94.1	82.2	N			
												2	91.0	3U	2500	0.8											
												4	91.0	3U	2450	0.8											
65-15	NUA4 216A3	F	N	9.0	N	+10	+ 5	15152	58	29.40	56	3	86.0	3U	2400	0.5	F										
												2	87.0	2U	3400	0.0											
												4	85.5	3U	2500	0.5											
29-20	NUA4 216A3	F	N	9.0	+	+ 5	+ 5	10308	70	30.20	52	3	93.5	2U	3300	0.9	91.0	3L	2000	2.0	Y	93.4	83.2	A	M	2U	3000	0.9
												2	96.0	2U	3300	0.9											
												4	89.0	3L	2000	1.0											
26-03	NUA4 216M5	F	N	9.0	Y	+ 5	+ 5	10597	68	30.48	52	3	93.0	4	2500	1.0	91.0	4	1500	2.0	N	93.0	83.2	A	M	3	2500	1.5
												2	94.0	3	2700	1.5											
												4	93.0	4	1350	1.0											
28-15	NUBG P16A4	F	N	9.4	Y	+10	+10	15212	70	29.39	50	3	86.5	4L	1900	0.5	86.0	4L	1850	1.5				N			
												2	87.0	4L	1900	0.5											
												4	85.0	4L	1850	0.5											
41-22	NUBG P16A4	C	N	9.4	Y	+10	+10	30147	75	30.32	36	3	90.0	4L	2200	1.0	F							N			
												2	90.0	4L	2300	1.0											
												4	90.0	4L	2500	1.0											
23-30	OE9 T19A3	F	N	9.0	Y	+10	+10	6322	70	28.92	50	3	94.0	3	1400	0.5	94.0	3	1400	0.5				A	M	3	1400	0.5
												2	94.0	3	1400	0.5											
												4	94.0	3	1400	0.5											
05-23	OE9 T19A3	F	N	9.0	Y	+10	+10	6280	69	29.60	52	3	85.0	3	1800	1.1					N	96.5	86.0	N			
												2	88.0	3	1700	1.2											
												4	85.0	3	1700	1.1											
23-29	OE9 T19A3	F	N	9.0	Y	+10	+10	16941	70	30.00	52	3	90.0	3	1450	0.6	99.5	3	1400	3.5				N			
												2	90.5	3	1200	0.6											
												4	90.0	3	1800	0.6											

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OBS NO	MODEL CODE	EMCT	KNK SEN	C.P.	SPARK ADVANCE AIR PRO	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION DRIVEWK	WATER OCT NO PRES	WATER OCT NO MOT	WATER INTK TMP	WATER GAGE PRES	WATER GAGE RPM	WATER GAGE MV
47-10	OE9 T19A3	C	N	9.0	Y	+10	+10	28900	70	30.10	50	3	93.0	3	1500	0.5	93.0	3	1500	2.0							
												2	94.0	3	1500	0.5											
												4	92.5	3	1400	0.5											
32-25	OE9 T19A3	F	N	9.0	Y	+10	+10	14681	70	29.77	50	3	94.0	3	1300	1.4	94.0	3	1300	4.0	Y			B	M	3	1500	1.4
												2	94.0	3	1350	1.4	94.0	3	1350	4.0								
												4	94.0	3	1300	1.4	94.0	3	1300	4.0								
32-29	OE9 T19A3	F	N	9.0	Y	+10	+10	13248	70	29.43	50	3	89.0	3	1500	1.0	89.0	3	1500	2.0	Y			A	M	3	1500	1.0
												2	89.0	3	1700	0.9	89.0	3	1700	2.0								
												4	89.0	3	1500	1.0	89.0	3	1500	2.0								
41-09	OE9 T19A3	C	N	9.0	Y	+10	+10	17996	56	30.23	59	3	91.0	2	1400	1.0	F							N				
												2	92.0	3	1300	1.0												
												4	90.0	3	1500	1.0												
65-12	OE9 T19A3	F	N	9.0	N	- 8	+ 8	8125	60	29.80	38	3	95.0	3	1500	1.0	95.0	3	1500	2.5								
												2	95.0	3	1500	1.0												
												4	95.0	3	1400	1.0	95.5	3	1400	2.5								
40-02	OE9 T19A3	F	N	9.0	N	+10	+10	7422	51	29.83	37	3	96.5	3	1500	4.0	96.5	3	1800					N				
												2	96.5	3	1500	4.0												
												4	94.5	3	1500	4.0	94.5	3	1800	3.0								
40-13	OE9 T19A3	F	N	9.0	N	+10	+10	8218	49	30.12	48	3	91.5	3	1500	0.5	89.0	3	1500	0.5				N				
												2	91.0	3	1500	0.5												
												4	91.5	3	1500	0.5												
07-07	OE9 T19A3	F	N	9.0	Y	+10	+10	13843	72	30.40	54	3	86.0	3	2100	0.9	86.0	3	1600	5.0								
												2	86.0	3	2500	0.9	87.0	3	1700	5.0								
												4	86.0	3	2100	0.9												
07-29	OE9 T19A3	F	N	9.0	Y	+10	+10	15560	72	30.19	43	3	87.0	3	2800	0.7	85.0	3	1800	4.0				N				
												2	90.0	3	2500	0.7												
												4	85.0	3	1900	0.7												
32-27	OE9 T19M4	F	N	9.0	Y	+10	+10	26454	70	29.09	50	3	93.0	4	1400	0.2	93.0	4	1200	2.0	N			B	P	4	1300	2.0
												2	94.0	4	1350	0.2	94.0	4	1200	2.0								
												4	93.0	4	1250	0.2	93.0	4	1200	2.0								
47-03	OEJ P19M5	C	N	9.0	Y	+ 8	+10	16700	70	30.24	50	3	91.0	4	1700	0.2	90.0	4	2000	2.0								
												2	91.0	4	1700	0.2												
												4	91.0	4	1600	0.2												
32-17	OEJ P19M5	F	N	9.0	Y	+10	+10	12614	70	29.56	50	3	88.0	4	1750	0.5	88.0	4	2100	2.0	N			N				
												2	87.0	4	1650	0.5	88.0	4	1800	2.0								
												4	88.0	4	1600	0.5	88.0	4	1700	2.0								

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OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE A I R	C.R.	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OMK	WATER OCT RES	WATER OCT MOT	WATER INT	WATER GEAR	WATER RPM	WATER MV
07-26	OFA P23A4	F	Y H	Y	9.6	+10	+10	6270	74	30.64	38	3	86.0	4U	2500	1.3	F							Y			
			H									2	84.0	3U	3000	1.9											
			H									4	85.0	3U	2950	1.9											
			L									3	85.0	4U	2500	1.3											
			L									2	84.0	3U	3000	1.9											
			L									4	84.0	4U	2550	1.3											
32-10	OFA P23M5	F	Y H	Y	9.5	+10	+10	13754	70	29.28	50	3	85.5	4	2800	0.9	86.0	4	1700	1.0	N			N			
			H									2	85.5	4	2800	0.8	85.5	4	1500	1.0							
			H									4	86.0	4	1400	0.5	86.0	4	1300	1.0							
			L									3	85.5	4	2800	0.8	86.0	4	1700	1.0							
			L									2	85.5	4	2800	0.8	85.5	4	1500	1.0							
			L									4	86.0	4	1400	0.5	86.0	4	1300	1.0							
05-23	OFE P50M5	F	Y H	Y	9.2	-10	-10	17883	12	30.43	0	3	89.0	3	900	0.4	F				N	95.1	83.3	N			
			H									2	88.0	3	1000	0.4											
			H									4	86.0	4	1200	0.4											
			L									3	88.0	3	900	0.4											
			L									2	86.0	3	900	0.4											
			L									4	84.0	4	1200	0.4											
28-07	OPF P50A4	F	N		8.9	Y	+10	+10	15839	70	29.35	50	3	78.0	2U	2100	0.5								N			
													2	78.0	2U	2100	0.5											
													4	79.0	2U	2100	0.5											
05-25	OPF P50A4	F	N		8.9	Y	+10	+10	10295	69	30.52	50	3	90.0	4L	1250	1.0					N	92.3	82.6	N			
													2	92.0	4L	1300	1.0											
													4	89.0	4L	1350	1.0											
41-24	OPF P50A4	F	N		8.9	Y	+10	+10	16050	69	30.23	45	3	86.0	4L	1300	1.0	84.0	4L	1100	4.0				N			
													2	87.0	3L	1500	1.5											
													4	87.0	4L	1300	1.0											
55-06	OPF P50A4	F	N		8.9	Y	+ 8	+10	15913	65	29.31	47	3	93.5	4U	1200	0.5	92.5	4L	1400	6.5							
													2					94.5	4L	1400	7.0							
													4	95.5	4U	1300	0.5											
47-27	OPF P50A4	C	N		8.9	Y	+10	+10	12400	70	30.05		3	92.0	4L	1500	1.0	90.0	4L	1800	4.0							
													2	92.0	4L	1500	1.0											
													4	92.0	4L	1500	1.0											
60-10	OPF P50A4	F	N		8.9	Y	+10	+10	25074	72	29.89	42	3	89.0	3U	2100	0.7	88.0	3U	1900	6.0	N	95.0	84.2	B	M	3U	1700	0.7
													2	88.0	4U	1250	0.9											
													4	87.0	3U	1650	0.7											

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OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	SPARK ADVANCE ADJ	SPARK ADVANCE BASRCD	SPARK ADVANCE TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION OCTANE KNOCK RES	TANK FUEL INFORMATION OCTANE KNOCK MOT	RATER NITE	RATER GEAR	RATER RPM	RATER MV
28-03	ORD T25A3	F	N	9.0	Y	+10	+10	16102	70	29.34	50	3	89.0	3	2900	1.0	85.0	3	2650	2.0			N			
												2	90.0	3	2750	1.0										
												4	87.0	3	2600	1.0										
65-19	ORD T25A3	F	N	9.0	Y	+10	+10	11366	48	29.48	33	3	90.5	3	2700	1.0	90.0	3	2700	3.0						
												2	92.0	3	2600	1.5										
												4	89.5	3	2800	1.0										
47-12	ORD T25A3	C	N	9.0	Y	+10	+10	21200	70	29.96	50	3	88.0	3	2800	1.0	85.0	3	2800	2.0						
												2	89.0	3	2800	1.0										
												4	86.0	3	2800	1.0										
32-12	ORD T25A3	F	N	9.0	Y	+10	+10	11859	71	29.62	53	3	85.0	3	3000	1.7	84.0	3	3000	3.0	N		N			
												2	85.0	3	3000	1.7										
												4	85.0	3	2700	1.5										
28-21	ORD P30A4	F	Y	H	9.3	Y	+10	+10	15094	70	29.13	50	3	91.0	4L	1450	0.5	88.0	4L	1500	1.5			N			
				H								2	91.0	4L	1550	0.5										
				H								4	91.0	4L	1500	0.5										
				L								3	89.0	4L	1500	0.5	87.0	4L	1500	1.5						
				L								2	90.0	4L	1500	0.5										
				L								4	89.0	4L	1500	0.5										
28-26	ORU P30A4	F	Y	H	9.3	Y	+10	+10	14843	70	29.50	50	3	92.0	4L	1500	1.0	91.0	4L	1550	2.0			B	M	4L	1500	1.0
				H								2	92.0	4L	1500	1.0										
				H								4	91.0	4L	1500	1.0										
				L								3	91.0	4L	1500	1.0	89.0	4L	1500	2.0						
				L								2	91.0	4L	1600	1.0										
				L								4	90.0	4L	1500	1.0										
08-20	ORU P30A4	F	Y	H	9.3	Y	+10	+10	10399	77	29.47	42	3	93.0	2U	3000	0.5	89.0	4L	1650	6.0			A	M	2U	3200	0.5
				H								2	95.0	3U	2450	1.0	92.0	4L	1450	6.0						
				H								4	91.0	3U	2450	1.0	88.0										
				L								3	90.0	2U	3200	0.5										
				L								2	92.0	2U	3200	0.5										
				L								4	88.0	2U	3000	0.5										
08-30	ORU P30A4	F	Y	H	9.3	Y	+10	+10	10541	70	30.09	24	3	95.0	4L	1450	2.0	92.0	4L	1900	6.0			B	M	4L	1600	2.0
				H								2	96.0	4L	1350	2.0										
				H								4	92.0	4L	1400	2.0										
				L								3	92.0	4L	1600	2.0										
				L								2	94.0	4L	1600	2.0										
				L								4	90.0	4L	1550	2.0										

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OBS NO	MODEL CODE	EMI CAT	KNK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AS BOO	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	EJECT	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OMK N	TANK FUEL INFORMATION RATER OCT NO RES	RATER OCT NO MOT	RATER INTN	RATER GEAR	RATER RPM	RATER MV
47-22	ORU P30A4	C	Y	9.3	Y	+10	-10	12200	70	30.13	50	3	89.0	4L	1400	0.5	98.0	4L	1400	4.0	Y	93.7	94.4	A	M	4L	1400	0.5
			H									2	100.0	4L	1400	0.5												
			H									4	95.0	4L	1300	0.5												
			L									3	98.0	4L	1400	0.5												
			L									2	89.0	4L	1400	0.5												
			L									4	94.0	4L	1300	0.5												
47-11	ORU P30A4	C	Y	H	9.3	Y	+ 8	+ 9	11300	70	30.22	50	3	93.0	4L	1400	0.5	91.0	4L	1400	1.5								
			H									2	94.0	4L	1400	0.5												
			H									4	92.0	4L	1400	0.5												
			L									3	92.0	4L	1400	0.5												
			L									2	92.0	4L	1400	0.5												
			L									4	91.0	4L	1400	0.5												
32-24	ORU P30A4	F	Y	H	9.3	Y	+10	+10	14670	70	29.95	50	3	86.0	4L	1500	0.8	86.0	4L	1500	2.0	N			N				
			H									2	87.0	4L	1600	0.8	87.0	4L	1500	2.0								
			H									4	86.0	4L	1500	0.8	86.0	4L	1500	2.0								
			L									3	85.0	4L	1600	0.8	85.0	4L	1600	2.0								
			L									2	86.0	4L	1600	0.8	86.0	4L	1600	2.0								
			L									4	85.0	4L	1600	0.8	85.0	4L	1600	2.0								
32-28	ORU P30A4	F	Y	H	9.3	Y	+10	+10	22620	70	29.77	50	3	91.0	3L	1500	1.0	90.0	3L	1400	4.0	N			B	P	3L	1400	4.0
			H									2	92.0	3L	1600	1.0	92.0	3L	1400	4.0								
			H									4	91.0	3L	1500	1.0	90.0	3L	1400	4.0								
			L									3	90.0	3L	1400	1.0												
			L									2	91.0	3L	1400	1.0												
			L									4	90.0	3L	1400	1.0												
07-05	ORU P30A4	F	Y	H	9.3	Y	+10	+10	14234	72	30.11	66	3	90.0	3U	2900	0.3	90.0	4L	1800	4.0	N			B	M	4L	1800	1.3
			H									2	90.0	4U	2400	0.8												
			H									4	80.0	4L	1900	1.3												
			L									3	88.0	4L	1900	1.3	86.0	4L	1800	4.0								
			L									2	89.0	3U	2600	0.3												
			L									4	89.0	4L	1900	1.3												
23-22	ORU P30A4	F	Y	H	9.3	Y	+10	+10	13973	70	30.00	57	3	93.0	4U	1500	0.4	92.5	4L	1400	2.0	Y	91.6	92.0	A	M	4L	1500	0.5
			H									2	94.5	3U	2300	0.4												
			H									4	94.0	4L	1400	0.5												
			L									3	93.0	4U	1500	0.4												
			L									2	94.5	3U	2300	0.4												
			L									4	93.0	4L	1500	0.5												

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OBS NO	MODEL CODE	EMI CT	KNK SEN	A/I R	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OMKN	RATER OCT RES	RATER OCT MOT	RATER INTR	RATER GEAR	RATER RPM	RATER MV
29-30	ORU P30A4	F	Y	H 9.3	Y +10	+10	16700	70	30.20	56	3	93.0	4L	1500	0.3	92.5	4L	1500	3.0				N			
				H							2	94.0	4L	1400	0.3											
				H							4	92.0	4L	1500	0.3											
				L							3	93.0	4L	1500	0.3											
				L							2	94.0	4L	1400	0.3											
				L							4	92.0	4L	1500	0.3											
29-03	ORU P30A4	F	Y	H 9.3	Y +10	+10	11643	70	30.00	57	3	94.5	4L	1500	1.0	92.5	4L	1500	7.5	N	95.8	86.9	N			
				H							2	97.0	3U	1900	0.9	97.5	3U	1900	8.0							
				H							4	93.0	4L	1500	1.0											
				L							3	94.5	4L	1500	1.0	92.5	4L	1500	7.5							
				L							2	96.0	3L	1850	0.9	97.5	3U	1900	8.0							
				L							4	93.0	4L	1500	1.0											
65-25	ORU P30A4	F	Y	H 9.3	Y +10	+10	8313	71	29.50	83	3	93.5	4L	1600	0.5	92.0	4L	1600	3.0							
				H							2	95.0	4L	1600	0.5											
				H							4	91.5	4L	1600	0.5											
				L							3	93.5	4L	1600	0.5											
				L							2	93.5	4L	1600	0.5											
				L							4	91.5	4L	1600	0.5											
32-21	ORU P30A4	F	Y	H 9.3	Y +10	+10	13933	70	29.37	49	3	87.5	4L	1400	1.4	87.5	4L	1300	3.0	N			N			
				H							2	88.0	4L	1300	1.4	88.0	4L	1150	3.0							
				H							4	87.5	4L	1400	1.4	87.5	4L	1300	3.0							
				L							3	87.5	4L	1400	1.4	87.5	4L	1400	3.0							
				L							2	87.0	4L	1400	1.4	87.0	4L	1400	3.0							
				L							4	87.5	4L	1400	1.4	87.5	4L	1300	3.0							
32-30	ORU P30A4	F	Y	H 9.3	Y +10	+10	31186	70	28.89	50	3	94.0	4L	1250	1.6	94.0	4L	1250	3.0	N			B	P	3L	1400	4.0
				H							2	95.0	4L	1250	1.6	96.0	3L	1500	4.0							
				H							4	94.0	4L	1250	1.6	94.0	4L	1250	3.0							
				L							3	90.0	4L	1250	1.6	90.0	4L	1250	3.0							
				L							2	90.0	4L	1300	1.6	91.0	4L	1300	3.0							
				L							4	90.0	4L	1500	1.8	90.0	4L	1250	3.0							
06-25	ORU P30A4	F	Y	H 9.3	Y -10	-10	10454	37	30.07	26	3	92.0	4U	1400	1.0	91.0	4U	1300	3.0	N	98.8	88.3	N			
				H							2	92.0	4U	1400	1.0											
				H							4	91.0	4U	1200	1.0											
				L							3	90.0	4U	1200	1.0	90.0	4U	1300	3.0							
				L							2	91.0	4U	1400	1.0											
				L							4	90.0	4U	1300	1.0											

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	VEHICLE DESCRIPTION								WEATHER			OCTANE NUMBER REQUIREMENT DATA									TANK FUEL INFORMATION							
						SPARK ADVANCE							MAXIMUM				PART THROTTLE					OCT NO		RATER				
OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWKNK	RES	MOT	NINT	THP	GEAR	RPM	MV
06-28	ORU P30A4	F	Y H	9.3	Y	-10	-10	21637	27	30.49	20	3	96.0	4U	1600	0.4	95.0	4U	1800	3.0	N	94.3	83.7	B	M	4U	1800	0.4
			H									2	95.0	4U	1500	0.4												
			H									4	95.0	4U	1600	0.4												
			L									3	93.0	4U	1800	0.4	92.0	4U	1800	3.0								
			L									2	92.0	4U	2000	0.4												
			L									4	93.0	4U	1400	0.4												
09-11	OS3 T38A4	F	N	8.7	Y	+10	+10	12362	80	29.80	41	3	86.0	3	1500	1.0	84.0	4	1150	4.0				N				
												2	87.0	3	1500	1.0												
												4	85.0	3	1500	1.0												
40-06	OS3 T38A4	F	N	8.7	Y	+10	+10	11239	56	30.05	51	3	92.0	3	1500	1.0	90.0	4	1500	2.0				N				
												2	93.5	3	1500	1.0												
												4	89.5	3	1600	2.0												
32-04	OS3 T38A4	F	N	8.7	Y	+10	+10	29963	70	29.63	53	3	87.0	4	1200	3.0	87.0	4	1200	4.0	N			N				
												2	87.0	4	1200	3.0	87.0	4	1200	4.0								
												4	87.0	4	1200	3.0	87.0	4	1200	4.0								
65-09	OS3 T38A4	F	N	8.7	Y	+10	+10	12406	48	29.53	30	3	91.5	3	1200	2.5	90.0	3	1400	3.0								
												2	91.5	3	1200	2.5												
												4	90.0	3	1200	2.5												
32-11	OSF P50A4	F	N	8.9	Y	+10	+10	11016	70	28.91	50	3	87.0	4	1000	2.7	87.0	4	1000	4.0	N			N				
												2	85.0	4	1000	2.7	84.0	4	1000	4.0								
												4	87.0	4	1100	2.7	86.0	4	1100	4.0								
41-17	OSWTP23A4	C	Y H	8.0	Y	+10	+10	11880	72	29.99	40	3	90.0	3U	3400	-8.0								A	M	4U	1800	-7.5
			H									2	90.0	3U	3300	-8.0												
			H									4	89.0	3U	3300	-8.0												
			L									3	90.0	3U	3000	-8.0												
			L									2	90.0	3U	3300	-8.0												
			L									4	89.0	3U	3300	-8.0												
29-04	OSWTP23M5	F	Y H	8.0	Y	+10	+10	7845	70	30.00	57	3	95.5	4U	1950	-17.0	96.5	4U	2100	0.0	Y	95.8	87.0	A	M	4U	1800	-17.0
			H									2	96.5	4U	1800	-17.0												
			H									4	H															
			L									3	95.5	4U	1950	-17.0	96.0	4U	2100	0.0								
			L									2	96.5	4U	1800	-17.0												
			L									4	H															
32-14	OTS T23A3	F	N	9.0	Y	+10	+10	7784	70	29.37	50	3	86.0	3	3300	1.2	86.0	3	1800	6.0	N			N				
												2	87.0	3	3300	1.2	87.0	3	1800	6.0								
												4	86.0	3	3000	1.2	86.0	3	1800	6.0								

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIP	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	CMRK	RATED OCT NO RES	RATED OCT NO MOT	RATED INT	RATED TRANS	RATED GEAR	RATED RPM	RATED MV
08-14	OTx T23A3	F	N	9.0	Y	+10	+10	8241	80	30.00	29	3	90.0	3	2950	1.5	87.0	3	2100	5.0				B	M	3	3150	1.5
												2	92.0	2	3200	1.2												
												4	89.0	3	2500	1.5												
08-02	OTx T23A3	F	N	9.0	Y	+10	+10	11492	70	30.60	22	3	92.0	3	3300	1.7	89.0	3	2400	5.0								
												2	94.0	3	3500	1.7												
												4	91.0	3	3300	1.7												
41-07	OTx T23A3	C	N	9.0	Y	+10	+10	13855	64	30.05	57	3	90.0	3	2700	1.0	F							N				
												2	91.0	3	2700	1.0												
												4	87.0	3	3000	1.0												
29-14	OTx T23A3	F	N	9.0	Y	+10	+10	18223	70	30.00	57	3	93.5	3	2350	0.5	95.0	3	2000	2.5	Y	90.9	82.0	A	M	3	2500	0.5
												2	95.0	3	2450	0.5	96.0	3	2400	3.0								
												4	92.5	2	2300	0.4												
32-13	OTx T23M5	F	N	9.0	Y	+10	+10	12945	70	29.29	48	3	86.0	4	1500	0.4	88.0	4	1400	2.0	N			N				
												2	88.0	3	2000	0.5	89.0	3	1850	2.0								
												4	88.0	4	1400	0.4	88.0	4	1400	2.0								
32-13	OTx T23M5	F	N	9.0	Y	+10	+10	14275	70	28.55	53	3	85.0	4	1300	0.5	86.0	4	1300	3.0	Y			N				
												2	85.0	4	1300	0.5	86.0	4	1400	3.0								
												4	85.0	4	1250	0.5	86.0	4	1300	3.0								
29-12	PED T22A3	F	N	9.5	Y	+12	+12	18761	70	30.00	65	3	93.5	3	1900	0.4	93.0	3	1900	2.0	Y	92.0	82.0	A	M	3	2100	0.4
												2	95.0	3	2000	0.4												
												4	91.0	2	2450	0.4												
08-29	PEETP22A3	A	Y	H	8.1	Y	+12	+12	10428	74	29.34	34	3	80.0	3	2500	-3.0	L						N				
				H								2	82.0	3	2500	-3.0												
				H								4	78.0	3	2600	-3.0												
				L								3	L															
				L								2	80.0	3	2600	-3.0												
				L								4																
08-08	PEK T25A3	A	N	9.0	Y	+12	+12	27670	78	29.95		3	88.0	2U	2500	0.8	F							N				
												2	99.0	2U	2500	0.8												
												4	85.0	2U	2500	0.8												
29-31	PEK T25A3	F	N	9.0	Y	+12	+12	10713	70	29.76	50	3	93.0	3U	1700	1.5	L							N				
												2	94.0	3U	1700	1.5												
												4	81.0	2U	2100	0.5												
41-12	PKD T22A3	C	N	9.5	Y	+10	+12	7556	68	30.13	56	3	85.0	2	3200	1.0								B	M	3	1900	1.0
												2	86.0	2	3300	1.0												
												4	84.0	2	2400	1.0												

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE A/T C.R.	SPARK ADVANCE A/T PRGD	SPARK ADVANCE M/T TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION	WATER				
																				OCTANE NUMBER			WATER		
																				OKN	RES	MOT	INIT	RPM	MV
60-01	PLC 222A3	F	N	9.0 Y	+10	+10	15688	72	30.25	46	3	90.0	3	2650	1.8	95.0	3	2500	5.0	Y	92.4	82.2	A M	3	2400	1.8
											2	95.0	3	2500	1.8	98.0	3	2400	5.0						
											4	88.0	3	2650	1.8										
26-02	PLC 222A3	F	N	9.0 Y	+10	+10	23342	68	30.60	52	3	86.0	3	1850	2.0	84.0	2	1700	4.0	N	92.0	87.1	N			
											2	89.0	3	1800	2.0										
											4	84.0	2	2100	2.0										
65-23	PLC 222A3	F	N	9.0 N	+10	+10	9631	56	29.65	44	3	96.0	2	3000	1.0	83.0	3	2500	3.0				N			
											2	88.0	2	3000	1.0										
											4	84.5	2	2500	1.0										
65-05	PLC 222A3	F	N	9.0 N	+10	+10	9019	65	29.31	47	3					87.5	3	2500	3.5							
											2	88.0	2	2000	0.0	88.5	3	2500	3.5							
											4	85.5	2	2000	0.0	85.0	3	2500	3.5							
62-03	PPD T22A3	F	N	9.5 Y	+12	+12	8602	69	30.26	55	3	92.0	2	2900	0.5	93.0	3	1600	8.0	O	92.0	82.1	A P	3	1700	8.0
											2	91.0	3	2100	0.8	95.0	3	1500	8.0							
											4	89.0	3	2300	0.8										
40-10	QA4 T18A3	F	N	9.5 N	+20	+20	9206	71	29.72	70	3	90.0	3	3100	0.5	F							N			
											2	90.0	3	3100	0.5										
											4	87.0	3	3000	0.5										
41-03	QA4 T18M5	C	N	9.5 Y			11590	68	30.08	66	3	89.0	3	4900	1.0								N	M	3	1.0
											2	92.0	3	5000	1.0										
											4	87.0	3	3500	1.0										
05-22	QC4 T18A3	F	N	9.5 Y	+20	+20	8173	70	30.50	30	3	91.0	3	3850	1.5	92.0	3	2500	6.0	N	94.8	86.0	N			
											2	93.0	3	3800	1.5	93.0	2	2750	5.0							
											4	90.0	2	3350	1.5										
09-06	R4A T17A3	A	N	9.5 Y			16926	72	29.61	50	3	88.0	3	2450	1.2	99.0	3	2100	8.0				N			
											2	92.0	3	2450	1.2	92.0	3	2100	8.0							
											4	88.0	3	2550	1.2	88.0	3	2050	8.0							
28-03	RAV T20M5	F	Y	H 9.5 Y			15239	70	29.33	50	3	87.0	4	3300	0.5	83.0	4	3200	2.0				N			
				H							2	86.0	4	3300	0.5										
				H							4	86.0	4	1700	0.5										
				L							3	83.0	4	3300	0.5										
				L							2	85.0	4	3300	0.5										
				L							4	85.0	4	1700	0.5										
32-08	SLM P50A4	F	N	9.2 Y	+ 9	+10	14656	40	29.91	50	3	92.0	4	1450	1.0	92.0	4	1400	2.0	N			A M	4	1650	1.0
											2	92.0	4	1300	1.0										
											4	92.0	4	1400	1.0										

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OBS NO	MODEL CODE	EMI CAT	EMI SEN	SPARK ADVANCE A/R	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	C.R.	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OCTANE MISMATCH	RATER OCT NO RES	RATER OCT NO MOT	RATER INT TYP	RATER GEAR	RATER RPM	RATER MV
08-04	SPF P50A4	F	N				8.9		80	29.90	29	3	86.0	4	1300	1.5	81.0	4	1300	6.0				N			
												2	86.0	2	2250	1.0											
												4	84.0	4	1300	1.5											
08-23	SPF P50A4	F	N				8.9		80	29.70	13	3	83.0	4	1400	2.0	82.0	4	1250	8.0				N			
												2	84.0	3	1500	1.5											
												4	83.0	4	1350	2.0											
29-26	TAE 115A3	F	N				9.3		70	30.00	52	3	85.5	2U	2900	0.8	84.0	3L	2000	2.5	Y			B	M	3L	2230	0.5
												2	88.0	2U	2900	0.8											
												4	84.0	3L	2500	0.8											
08-07	TAE 215A3	A	N				9.0		72	29.61	50	3	86.0	3L	2500	1.5	F							N			
												2	89.0	2U	4900	1.0											
												4	85.0	3L	2350	1.5											
08-25	TAE 215A3	A	N				9.0		78	29.28	58	3	90.0	2U	3700	1.0	90.0	3L	2250	8.0				N			
												2	92.0	2U	3700	1.0	92.0	3L	2250	8.0							
												4	88.0	3U	2700	1.0											
07-05	TAE 215A3	F	N				9.0		71	30.69	46	3	87.0	3U	2900	0.7	F				Y	94.8	83.2	N			
												2	88.0	2U	4500	0.8											
												4	86.0	3U	2900	0.7											
47-02	TAE 215M4	C	N				9.0		70	30.04	50	3	93.5	3	3800	0.8	99.0	4	1000	10.0							
												2	94.0	3	4000	0.8											
												4	93.0	4	1050	1.0											
29-12	TBA 216A3	F	N				9.0		70	29.32	50	3	90.0	2U	2600	0.5	F							N			
												2	91.0	2U	2700	0.5											
												4	88.0	2U	2500	0.5											
60-06	TBA 216A3	F	N				9.0		72	30.02	62	3	92.0	3L	2800	1.5	F				Y	92.3	82.1	B	M	3L	2900	2.2
												2	96.0	3L	2800	1.5											
												4	91.0	3L	2800	1.5											
47-03	TBA 216A3	C	N				9.0		70	30.00	50	3	94.0	3L	3300	0.8	F										
												2	97.0	3L	3250	0.8											
												4	91.0	3L	2700	0.8											
41-10	TBA 216A3	C	N				9.0		69	29.97	60	3	93.0	2U	2900	1.5	F							A	M	2U		1.5
												2	95.0	2U	3300	1.5											
												4	89.0	2U	3000	1.5											
06-11	TBA 216M5	F	N				9.0		52	30.03	27	3	93.0	4	2700	0.4	F				N	93.3	82.3	A	M	4	3200	0.4
												2	94.0	4	3200	0.4											
												4	93.0	3	1200	0.4											

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EM CT	KNK SEN	C.R.	IA PR	SPARK ADVANCE AS PCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OCTANE NUMBER REQUIREMENT DATA: OMAN	TANK FUEL INFORMATION: OCT NO	TANK FUEL INFORMATION: MOT	PATER: NIT	PATER: GTR	PATER: GEA	PATER: RPM	PATER: MV
26-37	TCA P16A4	F	N	9.4	Y	+10	+10	10780	70	29.56	50	3	86.0	4U	2100	0.5	86.0	4U	2100	1.5	N							
												2	90.0	4U	2100	0.5												
												4	87.0	4U	2100	0.5												
29-17	TDS P20M5	F	N	9.3	Y	+10	+10	9501	70	30.40	52	3	95.5	4	1000	0.2	94.5	4	1300	1.6		91.6	82.2	A	M	4	1100	0.2
												2	94.5	3	900	0.2												
												4	97.0	4	1000	0.2												
05-16	TES P20A4	F	N	9.3	Y	+10	+10	13908	69	30.05	50	3	86.0	4U	1750	0.8	F				N	92.0	82.8					
												2	86.0	4U	1750	0.8												
												4	84.0	4U	1725	0.8												
50-02	TES P20A4	F	N	9.3	Y	+10	+10	7011	71	30.20	40	3	88.0	4L	1950	0.5	88.0	4L	1950	2.0	N	92.6	82.2	N				
												2	88.0	4L	1950	0.5	88.0	4L	2050	2.0								
												4	88.0	4L	1950	0.5												
40-07	TES P20A4	F	N	9.3	Y	+10	+10	10625	54	29.74	48	3	92.0	3L	2300	1.0	91.0	4L	2000	2.0				N				
												2	95.0	3L	2300	1.0												
												4	91.0	3L	2300	1.0												
29-02	TES P20A4	F	N	9.3	Y	+10	+10	11258	70	30.10	57	3					89.5	4L	2250	3.0	N	95.8	87.3	N				
												2					91.0	4L	2200	3.0								
												4					86.5	4L	2250	3.0								
41-08	TES P20A4	C	N	9.3	Y	+10	+10	9138	68	30.03	53	3	86.0	3L	2200	1.0	F							N				
												2	88.0	3L	2600	1.0												
												4	87.0	3L	2400	1.0												
47-07	TES P20A4	C	N	9.3	Y	+10	+10	11570	70	30.12	50	3	90.0	4L	2000	0.5	91.0	4L	2000	2.0								
												2	92.0	4L	2000	0.5												
												4	90.0	4L	2000	0.5												
60-05	TFM P28A4	F	Y	H	9.2	Y	+10	+10	7572	68	30.40	63	3	83.0	4L	2000	1.2	81.0	4L	2000	3.0	N	92.3	82.2	N				
				H								2	84.0	2U	4300	0.6												
				H								4	82.0	4L	2100	1.2												
				L								3																
				L								2																
				L								4																
47-25	TGM P30A4	C	N		9.2	Y	+ 5	+ 5	20000	70	30.10	50	3	88.0	4L	2500	1.0	F											
												2	89.0	4L	2500	1.0												
												4	85.0	4L	2500	1.0												
47-23	VAB P23A4	C	N		9.8	Y	+12	+12	9250	70	29.80	50	3	90.0	4	2750	0.8	F				N	93.5	85.8					
												2	90.0	4	2900	0.8												
												4	90.0	4	2750	0.8												

'88' CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	E M C T	KNK SEN	A I R	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	E V E L	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	O # K N	WATER OCT NO RES	WATER OCT NO MOT	WATER N I T R	WATER S E N S	WATER RPM	WATER M.
07-04	AA8	P23M5	F N	8.8	Y	+12	+12	6947	72	29.97	44	3	89.0	4	2500	0.3	88.0	4	2500	3.0	N	93.0	87.5	B	M	4	2500	0.3
												2	91.0	3	3300	0.3											
												4	90.0	3	2700	0.3											
46-04	AA4	P27M5	F N	9.0	Y			15017	73	30.30	90	3	83.0	4	1800	0.8	82.0	4	1750	1.8	N	92.5	93.7	N				
												2	81.5	4	1100	0.8	81.0	4	1800	1.8							
												4	82.0	4	1700	0.8											
65-24	AA4	P27M5	F N	9.0	Y			11344	50	29.87	47	3	86.0	4	1700	0.5	85.0	4	2700	2.0							
												2	87.0	4	2000	0.5											
												4	86.0	4	1700	0.5											
06-02	DA	P16A3	F N	9.3	Y	+ 2	+ 2	18070	71	29.71	60	3	93.0	3	2800	1.0	92.0	3	2750	2.0	N	95.2	93.8	N				
												2	95.0	3	2750	1.0											
												4	90.0	3	2500	1.0											
06-29	DA	P16M5	F N	9.3		- 2	- 2	8431	36	30.20	22	3	92.0	4	2700	0.4	90.0	4	2900	1.4	N	94.2	93.7	N				
												2	92.0	4	2900	0.4											
												4	92.0	4	2450	0.4											
40-15	DA	P16M5	F N	9.3	N	+ 2	+ 2	41186	40	29.41		3	88.5	4	3000	0.5	85.5	4	3000	2.0				N				
												2	89.5	3	4500	0.5											
												4	89.0	4	3000	0.5											
06-21	DB	P20M5	F N	8.6	Y	- 6	- 6	9635	45	30.02	23	3	85.0	4	2200	0.8	82.0	4	2100	2.2	N	93.2	92.4	N				
												2	85.0	4	2400	0.8											
												4	86.0	4	2300	0.8											
06-11	DB	P20M5	F N	8.6	Y	+ 6	+ 6	19083	70	29.85	50	3	85.0	4	2220	0.2					N	92.6	93.5	N				
												2	88.0	4	2200	0.2											
												4	84.0	4	2250	0.2											
41-21	DB	TP20M5	C N	7.8	Y	+ 6	+ 6	18866	69	30.28	57	3	86.0	3	4200	-7.8	86.0	4	1900	-1.5	Y			N				
												2	86.0	3	4300	-7.8	86.0	4	2600	-1.5							
												4	87.0	3	4400	-7.8	86.0	4	2200	-1.5							
07-15	DC	P13A3	F N	9.4	Y	+ 5	+ 5	11090	71	30.45	53	3	85.0	3U	3400	0.8	81.0	4L	3000	3.0	N	95.7	94.4	N				
												2	84.0	3U	3400	0.8											
												4	83.0	3U	3400	0.8											
05-03	ZA4	21M4	F N	9.2	N	+ 5	+12	9812	70	30.20	41	3	95.0	4	4000	0.5	93.0	4	1900	1.5							
												2	97.0	4	4000	0.5											
												4	94.0	4	3950	0.5											
28-04	ETPHH	T30A4	F N	9.0	Y	+12	+12	16168	70	29.28	50	3	85.0	4L	1600	0.5	83.0	4L	1650	1.5				N				
												2	85.0	4L	1600	0.5											
												4	82.0	4L	1650	0.5											

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OBS NO	MODEL CODE	EMI	CYL	KNK SEN	SPARK ADVANCE C.R.	AIR INJ	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OCTANE NUMBER REQUIREMENT DATA: OMK	TANK FUEL INFORMATION: RATED OCT	RATED NO	INT	RATED GEAR	RATED RPM	RATED MV
85-21	ETPHN T24M5	F	N		8.3 N		+10	+10	22331	44	29.65	37	3					94.0	4	2000	4.5							
													2					95.0	4	2000	4.5							
													4					92.0	4	2000	4.5							
82-14	ETPHN T24M5	F	N		8.3 N		+10	+10	9162	72	30.25	42	3	89.0	4	3100	0.5	86.0	4	3100	2.0	N	93.5	87.9	N			
													2	91.0	4	3000	0.5											
													4	87.0	4	3150	0.5											
87-01	ETVBS T24A4	F	N		8.3 Y		+10	+10	14383	71	30.46	54	3	87.0	3	3500	0.8	85.0	4	2550	3.0	N	92.4	88.2	N			
													2	89.5	3	3300	0.8											
													4	85.0	4	2550	0.8											
46-14	ETPAA 213M4	F	N		8.4 N		+ 6	+ 6	8038	85	29.62	84	3	85.0	4	2050	2.0	F				N						
													2	95.0	4	1950	2.0											
													4	84.0	4	1600	2.0											
86-20	KTPDH 137A3	F	N		8.1 N		-16	-16	8337	56	29.69	33	3	90.0	3	2400	1.4	87.0	3	2600	3.0	N	92.1	92.4	N			
													2	93.0	3	2350	1.4											
													4	87.0	3	2200	1.4											
85-06	KTPNM 239A3	F	N		9.2 Y		+ 7	+ 7	6925	70	30.40	38	3	90.0	3L	2850	2.0	91.0	3L	3000	5.0	O	93.3	84.3	B	P	3L	3800	5.0
													2	92.0	3L	3000	2.0	94.0	3L	2900	5.0							
													4	87.0	3U	2250	1.5											
86-07	KTPNM 239A3	F	N		9.2 Y		+ 7	+ 7	18327	70	30.27	53	3	88.0	2U	1725	1.0	85.0	3L	2100	6.0	Y	93.2	83.2	N			
													2	91.0	2U	3000	1.0	92.0	3L	2050	7.0							
													4	87.0	2U	1725	1.0											
87-29	KTPNM 239A3	F	N		9.2 Y		+ 7	+ 8	6498	74	30.04	45	3	86.0	3L	2000	0.9	84.0	3L	2200	7.5	N	94.6	80.2	N			
													2	88.0	2U	2750	0.5											
													4	85.0	3U	2000	0.9											
28-35	KTPNM 239A3	F	N		9.2 Y		+ 7	+ 7	10495	70	28.94	50	3	88.0	3L	2500	0.5	91.0	3L	2550	7.0				N			
													2	90.0	3L	2500	0.5	94.5	3L	2500	7.0							
													4	86.0	2U	2300	0.5											
86-19	KTVBT 252A3	F	N		9.2 Y		- 8	- 8	6759	34	30.22	21	3	93.0	3	2200	1.5	94.0	3	2200	12.0	Y			N			
													2	94.0	3	2000	2.0	98.0	3	2000	12.0							
													4	94.0	2	1700	1.0											
88-15	KTVS3 P30A3	A	N		8.85 Y		+12	+12	12343	80	29.94	50	3	88.0	3U	2450	1.5	F							B	M	3U	2550	1.5
													2	92.0	3U	2550	1.5											
													4	86.0	3U	2450	1.5											
86-05	KTVS3 P30A3	F	N		8.85 Y		+12	+12	5651	41	29.65	23	3	L				L				N	99.0	87.6	N			
													2	L															
													4	L															

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OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OWNR	TANK FUEL OCT NO RES	TANK FUEL OCT NO MOT	NINT	THR	RATER GEAR	RATER RPM	RATER MV
47-03	KTVSG 22643	C	N	8.7	Y	+7	+7	12215	70	30.18	50	3	92.0	3	2500	1.2	F											
												2	93.0	3	2500	1.2												
												4	89.5	2	2250	1.0												
05-11	KITPFD 22044	F	N	8.5	N	+8	+8	7291	69	30.10	29	3	91.0	3	2600	1.5	87.0	3	2750	4.0	N	91.7	82.9	N				
												2	92.0	2	2500	1.5												
												4	89.0	2	2450	1.5												
47-05	KITPFD 220M5	C	N	8.5	N	+8	+8	7000	70	29.94	50	3	93.0	4	3500	1.0	94.0	4	3500	7.0								
												2	94.0	4	3500	1.0	95.0	4	2300	7.0								
												4	87.0	4	2000	1.0												
07-25	NTPGY 450A3	F	Y H	9.2	Y	0	0	32570	74	30.38	52	3	94.0	3L	2300	2.4	94.0	3L	1750	10.0	O	94.9	94.2	N				
			H									2	92.0	3L	2050	2.4												
			H									4	91.0	3L	2000	2.4												
			L									3																
			L									2																
			L									4																
75-06	NTPRH T50A3	F	Y H	9.2	Y	0	0	8198	65	29.29	62	3	93.5	2	1800	0.0	F							N				
			H									2	92.5	2	1900	0.0												
			H									4	90.5	3	2300	1.0												
			L									3	93.5	2	1800	0.0	F											
			L									2	92.5	2	1300	0.0												
			L									4	90.5	3	2300	1.0												
62-07	NTPRH T50A4	F	Y H	9.2	Y	+2	0	7515	70	30.52	42	3	93.5	2U	3200	0.7	F				N	97.6	95.7	A	M	2U	3000	0.7
			H									2	93.0	2U	3300	0.7												
			H									4	91.5	3U	2300	1.0												
			L									3	93.5	2U	3200	0.7	F											
			L									2	93.0	2U	3300	0.7												
			L									4	91.5	3U	2300	1.0												
05-03	NTPSE T25M5	F	N	8.3	N	+8	+8	9406	72	30.50	26	3	92.0	4	2250	1.0	100.5	4	3300	4.0	Y	97.0	87.0	A	P	4	2700	4.0
												2	93.0	4	2350	1.0	102.4	4	3350	4.0								
												4	91.0	4	2200	1.0	94.0	4	3300	4.0								
06-16	NTPSR T2844	F	Y H	8.9	Y	-10	-10	10537	44	29.60	21	3	95.0	4L	1700	1.0	95.0	4L	1600	2.0	N	94.6	83.5	B	M	4L	1900	1.0
			H									2	96.0	4L	1700	1.0												
			H									4	93.0	4L	1800	1.0												
			L									3	94.0	4L	1600	1.5	94.0	4L	1700	2.0								
			L									2	95.0	4L	1600	1.5												
			L									4	92.0	4L	1600	1.5												

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VEHICLE DESCRIPTION										WEATHER			OCTANE NUMBER REQUIREMENT DATA									TANK FUEL INFORMATION							
													MAXIMUM				PART THROTTLE								RATER				
OBS NO	MODEL CODE	EMCT	KNK SEN		C.R.	AIR	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWKNK	OCT NO RES	OCT NO MOT	NINT	THR	GEAR	RPM	MV
05-12	NTPSR T28A4	F	Y	H	8.9	N	+10	+10	3509	70	30.04	50	3	93.0	4L	1950	0.8	F				N	95.3	86.3	N				
				H									2	93.0	4L	1900	0.8												
				H									4	92.0	4L	1900	0.8												
				L									3	92.0	4L	1900	0.8												
				L									2	92.0	4L	1925	0.8												
				L									4	92.0	4L	1900	0.8												
46-09	NTPSR T28A4	F	Y	H	8.9	Y	+10	+10	10233	72	29.51	65	3	L				91.0	4L	1150	2.0	N	90.7	83.1	N				
				H									2					81.0	4L	1150	2.0								
				H									4	L				L											
				L									3	L				L											
				L									2					81.0	4L	1150	2.0								
				L									4	L				L											
07-13	NTPSR T28M4	F	Y	H	8.9	Y	+10	+10	13366	73	29.90	74	3	88.0	4	2200	0.2	89.0	4	2400	2.0	N	97.6	85.8	N				
				H									2	89.0	4	2300	0.2												
				H									4	87.0	4	2100	0.2												
				L									3	88.0	4	2200	0.2	87.0	4	2300	2.0								
				L									2	89.0	4	2300	0.2												
				L									4	85.0	4	2200	0.2												
45-13	NTPSZ T43A4	F	Y	H	9.3	Y	0	0	12202	79	29.61	65	3	90.0	2U	2750	1.0	F							N				
				H									2	91.0	3U	2350	1.0												
				H									4	91.0	2U	2300	1.0												
				L									3	89.0	2U	2900	1.0	F											
				L									2	91.0	2U	2200	1.0												
				L									4	88.0	2U	2350	1.0												
46-10	NTSRK T57A4	F	Y	H	9.1	Y	0	0	14549	76	29.36	96	3	88.0	3U	2650	2.5	F				N	92.5	83.0	N				
				H									2	88.0	3U	2800	2.5												
				H									4	87.0	3U	2550	2.5												
				L									3	88.0	3U	2650	2.5	F											
				L									2	88.0	3U	2800	2.5												
				L									4	87.0	3U	2550	2.5												
28-36	NTSPK T57A4	F	Y	H	9.1	Y	0	0	12991	70	29.18	50	3	89.0	2U	3200	0.5	F							N				
				H									2	89.0	2U	3200	0.5												
				H									4	88.0	2U	3000	0.5												
				L									3	87.0	2U	3000	0.5												
				L									2	88.0	2U	3200	0.5												
				L									4	87.0	2U	3000	0.5												

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OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE AIP	SPARK ADVANCE ASRCD	SPARK ADVANCE ASTST	C.R.	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAX OCT NO	MAX GEAR	MAX RPM	MAX MV	PART THR OCT NO	PART THR GEAR	PART THR RPM	PART THR MV	OCTANE NUMBER REQUIREMENT DATA: KNK	RATER: OCT NO RES	RATER: OCT NO MOT	RATER: INT TR	RATER: GEAR	RATER: RPM	RATER: MV
06-22	NTSRA T57A4	F	Y	H	9.1	Y	0	0	3632	22	30.51	10	3	94.0	3L	2250	2.0	92.0	3U	2700	3.5	N	92.9	92.3	B	M	3L	2150	2.0
				H									2	94.0	2U	2400	1.4												
				H									4	93.0	3U	2200	1.8												
				L									3	90.0	3L	2100	2.0	90.0	3U	2600	3.5								
				L									2	89.0	2U	4000	1.4												
				L									4	92.0	3U	2400	1.8												
75-04	NTSRA T57A4	F	Y	H	9.1	Y	0	0	10888	64	29.20	70	3	93.0	2U	2000	3.0	92.5	3U	2000	4.0	N			A	M	3U	1600	3.5
				H									2	93.5	2U	2300	3.0												
				H									4	89.5	2U	1700	3.0	89.5	3U	1500	4.0								
				L									3	93.0	2U	2000	3.0	92.5	3U	2000	4.0								
				L									2	93.5	2U	2300	3.0												
				L									4	89.5	2U	1700	3.0	89.5	3U	1500	4.0								
75-07	NTSRA T57A4	F	Y	H	9.1	Y	0	0	12767	67	29.24	58	3	93.5	2U	2100	2.0	F				N			A	M	2U	2300	2.0
				H									2	94.5	2U	2000	2.0												
				H									4	91.5	2U	2200	2.0												
				L									3	93.5	2U	2100	2.0	F											
				L									2	94.5	2U	2000	2.0												
				L									4	91.5	2U	2200	2.0												
65-17	NTSSE T25M5	F	N		8.3	N	+ 8	+ 8	14563	50	29.68	34	3					101.0	4U	2900	7.0								
													2					H	4U	2900	7.0								
													4					98.0	4U	1800	8.0								
47-04	NTSSR T28A4	C	Y	H	8.9	Y	+10	+10	17483	70	29.93	50	3	98.0	3U	3500	1.0	F											
				H									2	100.0	3U	3500	1.0												
				H									4	94.0	4L	1800	0.5												
				L									3	94.0	3U	3200	1.0	F											
				L									2	97.0	3U	3200	1.0												
				L									4	93.0	4L	1850	0.5												
47-18	NTSSR T28A4	C	Y	H	8.9	Y	+12	+10	9000	70	30.14	50	3	100.0	4L	1800	0.5	F											
				H									2	101.0	4L	2000	0.5												
				H									4	97.0	4L	1600	0.5												
				L									3	96.0	4L	1800	0.5												
				L									2	99.0	4L	2000	0.5												
				L									4	94.0	4L	1600	0.5												

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VEHICLE DESCRIPTION									WEATHER			OCTANE NUMBER REQUIREMENT DATA									TANK FUEL INFORMATION							
						SPARK ADVANCE							MAXIMUM				PART THROTTLE							RATER				
OBS NO	MODEL CODE	EMCT	KNK SEN	C.R.	AIR	AS RCO	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	OCT NO	GEAR	RPM	MV	OCT NO	GEAR	RPM	MV	OWNK	OCT NO RES	OCT NO MOT	NINT	THR	GEAR	RPM	MV
41-27	NTSSR T28A4	C	Y H	8.9	Y	+10	+10	5080	72	30.47	57	3	88.0	2U	3200	3.0	F				N	91.3	83.8	N				
			H									2	89.0	2U	3400	3.0												
			H									4	87.0	2U	3200	3.0												
			L									3																
			L									2																
			L									4																
28-32	NTSSR T28A4	F	Y H	8.9	Y	+10	+10	5463	70	29.90	50	3	98.0	3U	2500	0.5	F							N				
			H									2	88.0	4L	1600	0.5												
			H									4	87.0	4L	1600	0.5												
			L									3																
			L									2																
			L									4																
65-26	NTSSR T28A4	F	Y H	8.9	Y	+10	+10	33954	70	29.30	44	3	98.0	3L	2400	1.0	97.0	4L	1900	2.0								
			H									2	99.0	3L	2400	1.0	99.0	4L	1800	2.0								
			H									4	96.5	3L	2400	1.0												
			L									3	97.5	3L	2400	1.0												
			L									2	98.0	3L	2300	1.0	98.5	4L	1800	2.0								
			L									4	96.5	3L	2400	1.0												
65-20	NTSSI T43A3	F	Y H	9.3	N	0	0	10129	55	29.48	38	3	87.0	2U	2600	0.0	84.0	3U	2200	2.0								
			H									2	87.5	2U	2600	0.0												
			H									4	87.0	2U	2600	0.0												
			L									3																
			L									2																
			L									4																
46-08	NTVGK T57A4	F	Y H	9.1	Y	0	0	17661	73	29.30	57	3	92.0	2U	2500	2.0	F				N	91.3	82.1	N				
			H									2	92.0	2U	3250	2.0												
			H									4	91.0	2U	2150	2.0												
			L									3	91.0	2U	2350	2.0	F											
			L									2	91.0	2U	2900	2.0												
			L									4	90.0	2U	2250	2.0												
07-24	NTVGZ T43A3	F	Y H	9.3	N	0	0	13312	68	30.80	52	3	88.0	2	3000	0.5	F				N	92.4	82.7	N				
			H									2	86.0	3	2400	0.6												
			H									4	86.0	2	2900	0.5												
			L									3	88.0	2	3000	0.5	F											
			L									2	86.0	3	2400	0.6												
			L									4	85.0	2	2900	0.5												

'88' CRC OCTANE NUMBER REQUIREMENT SURVE'

OBS NO	MODEL CODE	EMCT	KNK SEN	C.P.	SPARK ADVANCE AIP	AS PCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	GEAR	RPM	MV	PART THROTTLE OCT NO	GEAR	RPM	MV	OWK	RATER OCT NO PES	OCT NO MOT	NIT	GTH	GEAR	RPM	MV
28-28	NTVGZ T43A4	F	Y H	9.3	Y	0	0	8253	70	29.40	50	3	82.0	2U	3900	0.5	L							N				
			H									2	86.0	3L	3900	0.5												
			H									4	81.0	3U	2300	0.5												
			L									3	81.0	2U	3900	0.5												
			L									2	86.0	2U	3900	0.5												
			L									4	81.0	3U	2300	0.5												
06-14	NTVGZ T43A4	F	Y H	9.3	Y	0	0	16826	54	30.21	44	3	97.0	3U	2300	1.0	F				N	94.6	83.5	A	M	3U	2250	1.0
			H									2	98.0	2U	3300	1.5												
			H									4	93.0	2U	2200	1.0												
			L									3	94.0	3U	2500	1.0												
			L									2	96.0	2U	3300	1.5												
			L									4	90.0	2U	2300	1.0												
60-08	NTVGZ T43A4	F	Y H	9.3	Y	0	0	19580	72	30.18	43	3	90.0	4L	1600	0.6	89.0	4L	1600	5.5	N	94.0	82.1	B	M	2U	2400	1.5
			H									2	92.0	3L	2600	0.6												
			H									4	92.0	4L	1450	0.6												
			L									3	89.0	4L	1600	0.6	87.0	4L	1600	5.5								
			L									2	91.0	3L	2500	0.6												
			L									4	89.0	4L	1600	0.6												
41-02	NTVGZ T43A4	C	Y H	9.3	Y	0	0	10834	64	30.08	58	3	92.0	3U	2500	1.0								B	M	3U	2300	1.0
			H									2	95.0	3U	2600	1.0												
			H									4	89.0	3U	2500	1.0												
			L									3	91.0	3U	2400	1.0												
			L									2	93.0	3U	2800	1.0												
			L									4	89.0	3U	2500	1.0												
46-16	OTPEN P50A4	F	Y H	9.0	Y	+10	+10	14588	74	29.39	78	3	H				H				N	91.3	82.3	B			1450	1.5
			H									2	H															
			H									4	H															
			L									3	99.0	4	1350	1.5	99.0	4	1300	2.5								
			L									2	87.0	4	1450	1.5												
			L									4	90.0	4	1300	1.5												
46-21	OTPEY P49A3	F	Y H	8.8	Y	+10	+10	8059	74	29.70	68	3	87.0	3	1975	2.0	86.0	3	2050	3.0	N	91.0	82.7	N				
			H									2	87.0	3	2000	2.0	86.0	3	2000	3.0								
			H									4	85.0	3	1950	2.0												
			L									3	86.0	3	2025	2.0	85.0	3	2075	3.0								
			L									2	85.0	3	1650	2.0												
			L									4	85.0	3	1950	2.0												

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OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE A I R	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION WORK	WATER OCT RES	WATER OCT MOT	WATER KNK INT	WATER THR GEAR	WATER RPM	WATER MV
46-13	OTPFY P43A3	F	Y	8.8	Y	+10	+10	6217	82	29.60	91	3	83.0	2	3350	1.5	L				90.8	83.1	N			1.5
			H									2	83.0	2	3250	1.5										
			H									4	82.0	2	2700	1.5										
			L									3	83.0	2	3350	1.5	L									
			L									2	82.0	2	2700	1.5										
			L									4	82.0	2	2700	1.5										
32-13	OTPFY P49M4	F	Y	H	8.9	Y	+ 6	+10	14894	70	29.73	50	3	90.0	4	800	0.3	91.0	4	1000	2.0						
			H									2	89.5	4	900	0.3	90.0	4	850	2.0						
			H									4	89.0	4	900	0.3	89.0	4	1000	2.0						
			L									3	88.0	4	900	0.3	88.0	4	1000	2.0						
			L									2	88.5	4	900	0.3	89.0	4	850	1.5						
			L									4	89.0	4	900	0.3	89.0	4	1000	2.0						
05-13	OTPRA P23M5	F	Y	H	9.5	Y	+10	+10	10898	70	29.76	50	3	90.0	4	1775	0.2	97.0	4	2600	8.0	N	94.5	94.0	N			
			H									2	91.0	4	1800	0.2										
			H									4	89.0	4	1750	0.2										
			L									3	90.0	4	1775	0.2										
			L									2	91.0	4	1800	0.2										
			L									4	89.0	4	1750	0.2										
32-15	OTPRA P23M5	F	Y	H	9.5	Y	+10	+10	10475	70	29.11	50	3	88.0	4	1400	0.4	88.0	4	1400	2.0	Y			B	M	4	1400	0.4
			H									2	87.0	4	1400	0.4	88.0	4	1400	2.0						
			H									4	88.0	4	1400	0.4	89.0	4	1400	2.0						
			L									3	87.0	4	1400	0.4	87.0	4	1400	2.0						
			L									2	86.0	4	1400	0.4	87.0	4	1400	2.0						
			L									4	88.0	4	1400	0.4	88.0	4	1400	2.0						
07-23	OTPRT P29A4	F	Y	H	9.0	Y			11480	67	30.10	43	3	87.0	4U	2800	0.8	F				N	92.3	82.1	N			
			H									2	88.0	4L	2000	1.5										
			H									4	84.0	4L	1950	1.5										
			L									3	84.0	4L	2100	1.5	82.0	4L	2000	5.5						
			L									2	98.0	4L	2000	1.5										
			L									4	84.0	4L	1950	1.5										
46-19	OTPRT P29M5	F	Y	H	9.0	Y	+10	+10	6814	73	29.50	65	3	84.0	4	1550	1.0	84.0	4	1775	2.0						
			H									2	86.0	4	1550	1.0										
			H									4	83.0	4	1750	1.0										
			L									3	84.0	4	1550	1.0	84.0	4	1775	2.0						
			-									2	94.0	4	1550	1.0										
			L									4	83.0	4	1750	1.0										

'88? CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE C.R.	AIR	AS RCD	AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION COMMUNK	RATER OCT PES	RATER OCT MOT	RATER INTR	RATER GEAR	RATER RPM	RATER MV
07-17	OTPRT P29M5	F	Y H	9.0	Y	+10	+10	20332	69	30.00	67	3	87.0	4	2300	0.3	87.0	4	2200	4.0	N	92.8	92.3	N			
			H									2	89.0	4	2200	0.3											
			H									4	85.0	4	2300	0.3											
			L									3	87.0	4	2300	0.3	87.0	4	2200	4.0							
			L									2	87.0	4	2200	0.3											
			L									4	85.0	4	2300	0.3											
32-09	OTSBT P29A4	F	H	9.0	Y	+12	+10	11728	70	29.02	53	3	L				L				N			N			
			H									2	L				L										
			H									4	L				L										
			L									3	L				L										
			L									2	L				L										
			L									4	L				L										
32-16	OTSBT P29A4	F	H	9.0	Y	+10	+10	22169	70	29.15	53	3	L				L				N			N			
			H									2	L				L										
			H									4	L				L										
			L									3	L				L										
			L									2	L				L										
			L									4	L				L										
28-09	OTVAU P30A4	F	N	9.3	Y	+10	+10	20402	70	29.36	50	3	85.0	4L	1800	0.7	84.0	4L	1800	1.0				N			
												2	85.0	4L	1800	0.7											
												4	84.0	4L	1800	0.7											
05-26	OTVAU P30A4	F	N	9.3	Y	+10	+10	7569	71	30.60	24	3	90.0	4L	2000	2.0	90.0	4L	1800	5.0	N	91.8	93.2	N			
												2	90.0	4L	1950	2.0											
												4	90.0	4L	2050	2.0											
32-07	OTVAU P30A4	F	N	9.3	Y	+ 8	+10	17836	70	29.73	50	3	87.0	4L	1900	0.8	88.0	4L	2000	3.0	Y			N			
												2	86.0	4L	2000	0.8	88.0	4L	2000	3.0							
												4	86.0	4L	2000	0.8	87.0	4L	1900	3.0							
47-24	OTVAU P30A4	C	N	9.3	Y	+10	+10	13288	70	30.22	50	3	88.0	4L	1600	0.8	87.0	4L	1600	2.0	N	93.7	94.0	N			
												2	88.0	4L	1600	0.8											
												4	88.0	4L	1600	0.8											
47-29	OTVAU P30A4	C	N	9.3	Y	+10	+10	13200	70	30.24	50	3	93.0	4L	1600	0.5	93.0	4L	1600	2.0							
												2	94.0	4L	1600	0.5											
												4	92.0	4L	1600	0.5											
41-29	OTVAU P30A4	C	N	9.3	Y	+10	+10	24493	71	30.28	40	3	87.0	3U	3000	1.0	86.0	4L	2900	4.0		92.7	93.2	N			
												2	88.0	3U	2600	1.0											
												4	86.0	3U	2850	1.0											

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMI CNT	TANK SEN	A/I R	SPARK ADVANCE AS PCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OMK N	RATER OCT RES	RATER NC MOT	RATER INT	RATER HR	RATER GEAR	RATER RPM	RATER MV
65-19	OTVAU P30A4	F	N	9.3 Y	+10	+10	15974	50	29.65	36	3	92.5	4L	1900	1.5	91.0	4L	1300	3.5								
											2	92.5	4L	1900	1.5												
											4	91.5	4L	2000	1.5												
29-19	OTVAU P30A4	F	N	9.3 Y	+10	+10	12109	70	30.20	52	3	92.0	4L	1900	0.6	91.0	4L	2000	2.0	Y	91.8	82.6	A	M	4L	2000	0.6
											2	92.0	4L	2000	0.6												
											4	91.0	4L	1800	0.6												
32-06	OTVAU P30M5	F	N	9.3 Y	+ 8	+10	8549	70	29.32	53	3	89.0	4	1700	0.4	90.0	4	1700	2.0	N			N				
											2	89.0	4	1900	0.4	90.0	4	1700	2.0								
											4	89.0	4	1700	0.4	90.0	4	1700	2.0								
32-03	OTVBY P49M4	F	Y	H	9.8 Y	+ 7	+10	23901	70	29.45	53	3	90.0	4	2000	0.6	91.0	3	3000	2.0								
				H							2	92.0	3	3000	1.2	94.0	3	3000	2.0								
				H							4	90.0	4	2000	0.6	89.5	4	2000	2.0								
				L							3	90.0	3	3000	1.2	90.0	4	1000	2.0								
				L							2	92.0	3	3000	1.2	92.0	3	3000	2.0								
				L							4	90.0	4	2000	0.6	89.5	4	2000	2.0								
07-20	OTVCN P50A3	F	Y	H	9.0 Y	+10	+10	31762	71	29.95	66	3	92.0	3U	2000	1.8	90.0	3U	1400	4.0	N	99.4	87.9	N				
				H							2	92.0	3L	1500	1.6												
				H							4	91.0	3U	1850	1.8												
				L							3	90.0	3U	2000	1.8	89.0	3U	1400	4.0								
				L							2	89.0	3L	1500	1.6												
				L							4	90.0	3L	1500	1.6												
07-31	OTVCN P50A3	F	Y	H	9.0 Y	+10	+10	37242	69	30.60		3	90.0	3L	1400	1.5	91.0	3L	1450	7.5	N	99.4	87.9	B	M	3U	1800	0.9
				H							2	90.0	3U	2000	0.9	91.0	3L	1400	7.5								
				H							4	91.0	3U	2000	0.9												
				L							3	89.0	3L	1400	1.5	87.0	3L	1500	7.5								
				L							2	89.0	3L	1500	1.5	89.0	3L	1500	7.5								
				L							4	90.0	3L	1500	1.5												
32-02	OTVCY P49M4	F	Y	H	9.8 Y	+11	+10	14294	70	29.22	50	3	94.5	4	1400	0.3	94.5	4	1100	2.0	N			A	M	4	1500	0.3
				H							2	95.0	4	1100	0.3	95.0	4	1100	2.0								
				H							4	96.0	4	1000	0.3	95.0	4	1100	2.0								
				L							3	94.0	4	1400	0.3	94.0	4	1100	2.0								
				L							2	94.0	4	1200	0.3	94.0	4	1400	2.0								
				L							4	94.0	4	1300	0.3	94.0	4	1100	2.0								

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMCT	KNK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AIR RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	OMKN	TANK FUEL INFORMATION OCT NO RES	OCT NO MOT	RATER NITE	RATER GEAR	RATER RPM	RATER MV
32-01	CTWCY P49M4	F	Y H	8.8	Y	+ 9	+10	16410	70	29.43	50	3	96.0	4	1300	0.3	95.0	4	1200	2.0	N			A	M	4	1000	0.3
			H									2	96.0	4	1200	0.3	95.0	4	1200	2.0								
			H									4	96.0	4	1200	0.3	95.0	4	1200	2.0								
			L									3	94.0	4	1200	0.3	94.0	4	1200	2.0								
			L									2	94.0	4	1200	0.3	94.0	4	1200	2.0								
			L									4	95.0	4	1300	0.3	94.0	4	1300	2.0								
28-15	CTAEN P50A4	F	Y H	9.0	Y	+10	+10	23299	70	29.33	48	3	88.0	4U	1255	2.0	90.0	4L	1550	3.5				B	P	4L	1000	5.0
			H									2	90.0	4U	1650	2.0	91.0	4L	1750	3.5								
			H									4	89.0	4U	1750	2.0	89.0	4L	1150	3.5								
			L									3																
			L									2																
			L									4																
28-20	PTVS3 P30A3	F	N	8.85	Y	+12	+12	8111	70	29.37	50	3	85.0	3U	2050	1.0	84.0	3U	2300	3.5				B	M	3U	2600	1.0
												2	87.0	3U	2250	1.0												
												4	84.0	3U	2275	1.0												
25-06	PTVS3 P30A3	F	N	8.85	Y	+12	+12	11490	70	29.49	50	3	81.0	2U	2700	0.5	L							N				
												2	82.0	2U	2700	0.5												
												4	78.0	2U	2540	0.5												
05-24	PTVS3 P30A3	F	N	8.85	Y	+12	+12	10097	70	30.02	54	3	81.0	3L	2550	1.0					N	92.3	83.1	N				
												2	83.0	3L	2600	1.0												
												4	80.0	3L	2750	0.9												
46-03	PTVS3 P30A3	F	N	8.85	Y	+12	+12	7122	71	29.12	69	3	81.0	3U	2850	1.2	L				N	90.2	83.0	N				
												2	82.0	3L	2550	1.2												
												4	80.0	3U	3150	1.2												
07-30	PTVS3 P30A3	F	N	8.85	Y	+12	+12	6104	69	29.84	39	3	82.0	3U	2900	0.8	L				N	92.4	82.2	N				
												2	82.0	3L	2500	0.8												
												4	80.0	2U	4000	0.5												
29-24	PTVS3 P30A3	F	N	8.85	Y	+12	+12	11325	70	30.10	56	3	88.0	3L	2000	0.8	86.5	3U	2000	3.0	Y			A	M	3U	2000	0.8
												2	91.5	3U	2000	0.8												
												4	87.5	2U	2300	0.7												
26-05	PTVS3 P30A3	F	N	8.85	Y	+12	+12	14085	70	30.03	53	3	81.0	2U	2200	1.0	L				N	92.9	83.2	N				
												2	82.0	3L	2000	1.0												
												4	78.0	3L	2050	1.0												
25-03	PTVSG 226A3	F	N	9.7	Y	+ 7	+ 7	20499	70	29.28	50	3	94.0	3	2550	2.0	94.0	3	2450	3.5				B	M	2	3050	1.5
												2	94.0	3	2300	2.0	95.0	3	2550	3.5								
												4	92.0	3	2550	2.0	92.0	3	2475	3.5								

1987 CRC OCTANE NUMBER REQUIREMENT SURVEY

OBS NO	MODEL CODE	EMIT	KNK SEN	SPARK ADVANCE AIR C.R.	SPARK ADVANCE AIR PRES	SPARK ADVANCE AS RCD	SPARK ADVANCE AS TST	ODOM MILES	AMB TMP	BAROM	HUM	FUEL	MAXIMUM OCT NO	MAXIMUM GEAR	MAXIMUM RPM	MAXIMUM MV	PART THROTTLE OCT NO	PART THROTTLE GEAR	PART THROTTLE RPM	PART THROTTLE MV	TANK FUEL INFORMATION OCTANE NUMBER RATER WORK	RATER OCT NO RES	RATER OCT NO MOT	RATER INIT	RATER GEAR TRR	RATER GEAR RPM	RATER MV
25-07	PTVSG 226A3	F	N	8.7	Y	+ 7	+ 7	16742	70	29.40	50	3	93.0	2	2200	0.5	91.0	2	2100	1.5				A	M 2	2200	1.5
												2	94.0	2	2250	0.5											
												4	91.0	2	2100	0.5											
05-04	PTVSG 226A3	F	N	8.7	Y	+ 7	+ 7	15757	71	30.00	24	3	93.0	2	2400	3.0	90.0	2	2500	4.0	N	97.3	86.7	N			
												2	95.0	2	2500	3.0											
												4	90.0	2	2500	3.0											
06-10	RTPBM P40A4	F	N	9.2	N	+16	+16	4847	66	29.84	55	3	92.0	4U	2000	0.9	88.5	3L	2600	2.2	N	93.4	83.0	A	M 3L	2600	0.8
												2	93.0	3L	2700	0.8											
												4	90.0	4U	1900	0.9											
62-10	RTSAM P40A4	F	N	9.2	Y			10180	72	29.84	58	3	87.0	4L	1900	0.8	F				N	97.2	86.7	N			
												2	87.0	3L	1850	1.0											
												4	86.0	4L	1900	0.9											
47-21	TTPIR 224A4	C	N	9.3	Y	0	0	6500	70	30.34	50	3	91.0	3	3800	1.0	F				N	97.0	86.0				
												2	93.0	3	3750	1.0											
												4	87.5	3	3500	1.0											
47-29	TTPIR 224A4	C	N	9.3	N	+ 2	0	6100	70	30.18	50	3	88.0	4	2800	0.8	86.0	4	2800	2.0							
												2	90.0	4	2800	0.8											
												4	87.0	4	2800	0.8											
41-16	TTPIR 224M4	C	N	9.3	N	0	0	13190	75	29.82	65	3	91.0	4	1200	1.0					N			N			
												2	91.0	4	1400	1.0											
												4	94.0	4	1400	1.0											
05-14	TTPIR 224M5	F	N	9.3	N	0	0	10442	69	30.35	50	3	87.0	4	1675	0.5					N	93.0	93.3	N			
												2	88.0	4	1700	0.5											
												4	88.0	4	1700	0.5											
60-03	TTPIR 224M5	F	N	9.3	N	0	0	8146	72	30.25	40	3	90.0	4	1800	0.5	89.0	4	1800	2.5	N	94.7	84.4	N			
												2	90.0	4	1800	0.5											
												4	90.0	4	2000	0.5											
47-17	TTPIR 224M5	C	N	9.3	N	+ 2	0	19500	70	29.99	50	3	89.0	4	1650	0.5	F										
												2	89.0	4	3400	0.5											
												4	89.0	4	1500	0.5											
06-01	ZTPD1 220M5	F	N	8.6	N	+ 6	+ 6	8129	59	30.01	54	3	89.5	4	1600	0.5	89.0	4	1500	1.6	N	99.0	87.6	N			
												2	90.0	4	1400	0.4											
												4	88.0	4	1700	0.5											
47-05	ZTPD1 220M5	C	N	8.6	Y	+ 6	+ 6	6153	70	30.10	50	3	88.0	4	1300	1.0	F										
												2	88.0	4	1350	1.0	F										
												4	88.0	4	1200	1.0											

APPENDIX F

PROCEDURES FOR CALCULATING AND PLOTTING OCTANE NUMBER REQUIREMENT DISTRIBUTION DATA

WEIGHTED VEHICLE/CAR POPULATIONS

Weighting factors for each vehicle model were developed from information supplied by the US vehicle manufacturers and from information published (Ward's Automotive Reports) for imported vehicles. These weight factors were proportioned to the relative production and/or sales volumes of the vehicles tested.

For any vehicle having octane requirements lower (L) than the lowest octane number fuel available within a given fuel series, a number 0.5 Research/0.4 Motor lower was assigned. Similarly, for any vehicle having octane requirements higher (H) than the highest octane fuel available within a given fuel series, a number 0.5 Research/0.4 Motor higher was assigned.

The weighting factors of each vehicle model were divided by the number of vehicles tested to calculate individual vehicle weight factors. The octane requirements for each vehicle were then arranged in increasing order with the appropriate individual weighting factors. The percent of vehicles at each octane requirement level represents the summation of all vehicle weighting factors before that level, plus one-half the sum of the weighting factors at that level. The individual vehicle weighting factors are adjusted so that the summation of all weighting factors is 100.00 for any vehicle population of interest. The midpoint percentiles are plotted versus octane number requirement on arithmetic probability paper and a distribution curve is drawn through the points.

SELECT CAR MODELS

For individual car models, the octane number requirement distribution curves were plotted by the "Z" method as described in "Statistical Estimation of the Gasoline Octane Number Requirement of New Model Automobiles," C. S. Brinegar and R. R. Miller, Technometrics, Vol. 2, No. 1, February 1960.

The procedure is as follows:

For any cars having octane requirements lower (L) than the lowest octane number fuel available within a given fuel level, a number 1.0 Research/0.7 Motor lower was assigned. Similarly, for individual cars having octane requirements higher (H) than the highest octane fuel available within a given fuel series, a number 1.5 Research/1.1 Motor higher was assigned.

Using all observed and estimated octane number values, calculate the mean ($\bar{X}$) and the standard deviation (s) from the data for each car model.

$$s = \left[\frac{1}{n-1} \sum_{i=1}^{n} (X - \bar{X})^2 \right]^{1/2}$$

Where X_i = Octane number requirement of i^{th} car of a given model

n = Number of cars of that model.

Estimate octane number requirements at the percentiles of interest from octane number requirement distribution data by

$$O.N. = \bar{X} + ks$$

Where k is selected from normal distribution tables.

Values of k used to calculate percentiles in this report are:

Percentile	k
5	-1.645
10	-1.282
20	-0.842
30	-0.524
40	-0.253
50	0
60	+0.253
70	+0.524
80	+0.842
90	+1.282
95	+1.645

APPENDIX 6

CONFIDENCE LIMITS OF
OCTANE NUMBER REQUIREMENT DISTRIBUTIONS

CONFIDENCE LIMITS OF OCTANE NUMBER REQUIREMENT DISTRIBUTIONS

Octane number requirements of vehicles presented in this Survey are determined at the levels that satisfy certain percentages of specific vehicle populations. In many cases, the recorded octane number requirement is followed by a plus and minus limit, referred to as the confidence interval. These limits are expected to bound the true requirement of the population represented by the test vehicles 95 percent of the time in replicate testing of the same number of test vehicles.

At the 50 percent satisfaction level, the 95 percent confidence interval is calculated as follows:

$$CI = \pm ts/(n)^{1/2}$$

where t = Students t at the proper number of degrees of freedom*

s = Standard deviation, calculated directly from the data or estimated as the difference between the 84.16th and 50th percentiles (assuming normal distribution)

n = Number of vehicles in population.

At other satisfaction levels:

$$CI = \pm ts \quad 1/n + k^2/[2(n-1)]^{1/2}$$

At the 90 percent satisfaction level, k = 1.2817. For other satisfaction levels, appropriate values for k may be found in the standard statistical tables.

Degrees of Freedom**	t	Degrees of Freedom**	t
1	12.706	18	2.101
2	4.393	19	2.093
3	3.182	20	2.086
4	2.776	21	2.080
5	2.571	22	2.074
6	2.447	23	2.069
7	2.365	24	2.064
8	2.306	25	2.060
9	2.262	26	2.056
10	2.228	27	2.052
11	2.201	28	2.048
12	2.179	29	2.045
13	2.160	30	2.042
14	2.145	40	2.021
15	2.131	60	2.000
16	2.120	120	1.980
17	2.110	∞	1.960

* Distribution of t for probability = 0.05.
** Degrees of Freedom = (n-1).

TABLE G-I

95% CONFIDENCE LIMITS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS

1987 Weighted Population Groups

Population	Fuel	No. Veh.	t	Standard Dev. RON	Standard Dev. MON	Standard Dev. (R+M)/2	95% Confidence Limits RON 50%	RON 90%	MON 50%	MON 90%	(R+M)/2 50%	(R+M)/2 90%
Total Vehicles												
Includes Knock Sensor	PR	389	1.966	4.47	4.47	4.47	0.45	0.60	0.45	0.60	0.45	0.60
Maximum (High-Borderline)	FBRU	389	1.966	4.52	2.85	3.68	0.45	0.61	0.28	0.38	0.36	0.49
Requirements	FBRSU	389	1.966	4.89	3.51	4.20	0.49	0.66	0.35	0.47	0.42	0.56
Includes Knock Sensor	PR	376	1.966	4.18	4.18	4.18	0.42	0.57	0.42	0.57	0.42	0.57
Minimum (Low-Borderline)	FBRU	377	1.966	4.36	2.71	3.53	0.44	0.60	0.27	0.37	0.35	0.48
Requirements	FBRSU	377	1.966	4.85	3.44	4.14	0.49	0.66	0.35	0.47	0.42	0.56
Total Cars												
Includes Knock Sensor	PR	300	1.968	4.72	4.72	4.72	0.54	0.72	0.54	0.72	0.54	0.72
Maximum (High-Borderline)	FBRU	300	1.968	4.90	3.08	3.99	0.56	0.75	0.35	0.47	0.45	0.61
Requirements	FBRSU	300	1.968	5.23	3.75	4.49	0.59	0.80	0.43	0.58	0.51	0.69
Includes Knock Sensor	PR	292	1.968	4.52	4.52	4.52	0.52	0.70	0.52	0.70	0.52	0.70
Minimum (Low-Borderline)	FBRU	293	1.968	4.63	2.87	3.75	0.53	0.72	0.33	0.45	0.43	0.58
Requirements	FBRSU	293	1.968	5.03	3.57	4.30	0.58	0.78	0.41	0.55	0.49	0.66
Total Trucks and Vans												
Includes Knock Sensor	PR	89	1.986	3.91	3.91	3.91	0.82	1.11	0.82	1.11	0.82	1.11
Maximum (High-Borderline)	FBRU	89	1.986	3.72	2.36	3.04	0.78	1.06	0.50	0.67	0.64	0.86
Requirements	FBRSU	89	1.986	4.25	3.07	3.66	0.90	1.21	0.65	0.87	0.77	1.04
Includes Knock Sensor	PR	84	1.988	3.63	3.63	3.63	0.79	1.07	0.79	1.07	0.79	1.07
Minimum (Low-Borderline)	FBRU	84	1.988	3.87	2.42	3.14	0.84	1.14	0.52	0.71	0.68	0.92
Requirements	FBRSU	84	1.988	4.37	3.09	3.73	0.95	1.28	0.67	0.91	0.81	1.09

TABLE G-I
(Continued)

95% CONFIDENCE LIMITS FOR MAXIMUM OCTANE NUMBER REQUIREMENTS

1987 Weighted Population Groups

Population	Fuel	No. Veh.	t	Standard Dev.			95% Confidence Limits					
							RON		MON		(R+M)/2	
				RON	MON	(R+M)/2	50%	90%	50%	90%	50%	90%
Total Knock-Sensor Vehicles												
Includes Knock Sensor	PR	136	1.978	4.15	4.15	4.15	0.70	0.95	0.70	0.95	0.70	0.95
Maximum (High-Borderline)	FBRU	136	1.978	4.79	3.15	3.97	0.81	1.10	0.53	0.72	0.67	0.91
Requirements	FBRSU	136	1.978	5.41	3.92	4.66	0.92	1.24	0.67	0.90	0.79	1.07
Includes Knock Sensor	PR	123	1.980	3.26	3.26	3.26	0.58	0.79	0.58	0.79	0.58	0.79
Minimum (Low-Borderline)	FBRU	124	1.979	4.25	2.64	3.44	0.75	1.02	0.47	0.64	0.61	0.83
Requirements	FBRSU	124	1.979	4.75	3.35	4.05	0.84	1.14	0.59	0.80	0.71	0.97

TABLE G-II

95% CONFIDENCE LIMITS FOR MAXIMUM (R+M)/2, RON, AND MON REQUIREMENTS

1987 Select Models

Model	Fuel	n	t	Std.Dev. (s) (R+M)/2	95% Confidence Limits, (R+M)/2 50% Satis.	95% Confidence Limits, (R+M)/2 90% Satis.	Std.Dev. (s) RON	95% Confidence Limits, RON 50% Satis.	95% Confidence Limits, RON 90% Satis.	Std.Dev. (s) MON	95% Confidence Limits, MON 50% Satis.	95% Confidence Limits, MON 90% Satis.
PED T22A3/PKD T22A3/	PR	10	2.26	2.9	2.1	2.9	2.9	2.1	2.9	2.9	2.1	2.9
PPD T22A3/KKD T22A3/	FBRU	10	2.26	2.8	2.0	2.7	3.4	2.4	3.3	2.2	1.6	2.2
KKD T22A3/DHD T22A3	FBRSU	10	2.26	3.3	2.4	3.3	3.9	2.8	3.9	2.7	1.9	2.7
OE9 T19A3/ME9 T19A3	PR	12	2.20	3.7	2.4	3.3	3.7	2.4	3.3	3.7	2.4	3.3
	FBRU	12	2.20	3.1	1.9	2.7	3.7	2.4	3.2	2.4	1.5	2.1
	FBRSU	12	2.20	2.5	1.6	2.2	3.0	1.9	2.6	2.1	1.3	1.8
OPF P50A4/OSF P50A4/	PR	12	2.20	4.3	2.7	3.8	4.3	2.7	3.8	4.3	2.7	3.8
MPF P50A4/MSF P50A4/	FBRU	12	2.20	3.2	2.0	2.8	3.9	2.4	3.4	2.6	1.6	2.2
SPF P50A4	FBRSU	12	2.20	3.5	2.2	3.1	4.1	2.6	3.6	2.8	1.8	2.5
ORU P30A4/MRU P30A4/ (High-Borderline)	PR	17	2.12	2.4	1.2	1.7	2.4	1.2	1.7	2.4	1.2	1.7
	FBRU	17	2.12	2.5	1.3	1.8	3.0	1.6	2.1	2.0	1.0	1.4
	FBRSU	17	2.12	2.9	1.5	2.0	3.3	1.7	2.3	2.4	1.2	1.7
ORU P30A4/MRU P30A4/ (Low-Borderline)	PR	17	2.12	2.3	1.2	1.6	2.3	1.2	1.6	2.3	1.2	1.6
	FBRU	17	2.12	2.5	1.3	1.8	3.0	1.6	2.1	2.0	1.0	1.4
	FBRSU	17	2.12	2.8	1.5	2.0	3.3	1.7	2.3	2.4	1.2	1.7

TABLE G-II
(Continued)

95% CONFIDENCE LIMITS FOR MAXIMUM (R+M)/2, RON, AND MON REQUIREMENTS

1986 Select Models

Model	Fuel	n	t	Std.Dev. (s) (R+M)/2	95% Confidence Limits, (R+M)/2 50% Satis.	95% Confidence Limits, (R+M)/2 90% Satis.	Std.Dev. (s) RON	95% Confidence Limits, RON 50% Satis.	95% Confidence Limits, RON 90% Satis.	Std.Dev. (s) MON	95% Confidence Limits, MON 50% Satis.	95% Confidence Limits, MON 90% Satis.
NAR T25A3/HAR T25A3/	PR	17	2.12	2.5	1.3	1.7	2.5	1.3	1.7	2.5	1.3	1.7
IAR T25A3/LAR T25A3	FBRU	17	2.12	2.6	1.4	1.9	3.1	1.6	2.2	3.4	1.8	2.4
	FBRSU	17	2.12	3.1	1.6	2.1	3.4	1.8	2.4	2.7	1.4	1.9
NJ1 T20A3/LJ1 T20A3	PR	13	2.18	2.5	1.5	2.1	2.5	1.5	2.1	2.5	1.5	2.1
	FBRU	13	2.18	2.0	1.2	1.6	2.4	1.4	2.0	1.5	0.9	1.3
	FBRSU	13	2.18	2.3	1.4	1.9	2.7	1.6	2.2	1.9	1.1	1.6
NAW P28A3/HAW P28A3/	PR	10	2.26	5.2	3.8	5.2	5.2	3.8	5.2	5.2	3.8	5.2
IAW P28A3/LAW P28A3/	FBRU	10	2.26	4.3	3.1	4.3	5.1	3.7	5.1	3.5	2.5	3.4
NJW P28A3/GJW P28A3	FBRSU	10	2.26	5.7	4.1	5.6	6.5	4.6	6.4	4.9	3.5	4.8
(High-Borderline)												
NAW P28A3/HAW P28A3/	PR	10	2.26	5.3	3.8	5.2	5.3	3.8	5.2	5.3	3.8	5.2
IAW P28A3/LAW P28A3/	FBRU	10	2.26	4.6	3.3	4.5	5.5	3.9	5.4	3.7	2.6	3.6
NJW P28A3/GJW P28A3	FBRSU	10	2.26	5.7	4.1	5.6	6.5	4.6	6.4	4.9	3.5	4.8
(Low-Borderline)												
IH3 P38A4/IC3 P38A4/	PR	15	2.14	5.3	2.9	4.0	5.3	2.9	4.0	5.3	2.9	4.0
HH3 P38A4/LH3 P38A4/	FBRU	15	2.14	3.0	1.6	2.3	3.6	2.0	2.7	2.3	1.3	1.8
(High-Borderline)	FBRSU	15	2.14	4.1	2.3	3.2	4.9	2.7	3.7	3.4	1.9	2.6
IH3 P38A4/IC3 P38A4/	PR	15	2.14	5.0	2.8	3.8	5.0	2.8	3.8	5.0	2.8	3.8
HH3 P38A4/LH3 P38A4/	FBRU	15	2.14	3.2	2.9	4.0	3.9	2.1	2.9	2.5	1.4	1.9
(Low-Borderline)	FBRSU	15	2.14	4.4	2.4	3.4	5.2	2.9	4.0	3.6	2.0	2.8